Proceedings of
The Fifteenth International
Conference on Electronic Business

"Internet of Things"

Edited by

Timon C. Du, The Chinese University of Hong Kong, Hong Kong
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ISSN: 1683-0040
Preface
Welcome to the 15th International Conference on Electronic Business (ICEB) in Hong Kong. The theme of this year’s Conference is “Internet of Things.” We have received 94 submissions and 80 registrations. Among them, 79 papers are included in the Proceedings.

In 2000, we hosted the first ICEB conference in Hong Kong. Now, 15 years later, after traveling around the world, the conference is returning to Hong Kong for the fourth time. The past 20 years have seen the Internet grow tremendously, with a wide range of new applications and platforms developed. E-commerce, cloud computing, and big data are just a few of the most familiar. At ICEB 2015, we will turn our attention to and adopt as our theme one of the latest Internet developments: the Internet of Things (IOT).

The IOT assigns unique identifications to individual objects, be they human beings, animals, cars, buildings, phones, watches, toilet bowls, animals, or objects we have yet to imagine. These uniquely identified embedded objects are connected through the Internet in wired or wireless fashion. The IOT is anticipated to host billions upon billions of interconnected objects in the coming decades. With the help of sensors, receivers, and big data analytics, the IOT is set to reinvent the world as we know it, giving us new ways to monitor, use, manage, automate, and play. Healthcare, finance, retail, logistics, wearable computing, and food processing are just a few of the many areas slated for reinvention in the exciting new IOT era. In this conference, we will share the excitement, explore the new developments the era is likely to usher in, and renew old friendships and start new ones.

The conference is co-organized by Department of Decision Sciences and Managerial Economics of The Chinese University of Hong Kong and International Consortium of Electronic Business and is sponsored by Department of Decision Sciences and Managerial Economics and Faculty of Business Administration of The Chinese University of Hong Kong. We would like to thank the sponsors for their generous funding and support. Finally, on behalf of the entire Conference Committee, we sincerely wish you have a very productive and memorable experience during your stay in Hong Kong.

Cordially yours,

Timon C. Du & Waiman Cheung
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The Chinese University of Hong Kong, Hong Kong
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International Consortium of Electronic Business
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The Fifteenth International Conference on Electronic Business, Hong Kong, December 6-10, 2015
A CASE STUDY OF RESEARCH TRENDS OF INTERNET OF THINGS
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ABSTRACT
In recent years, the technologies of Internet of Things (IoT) have been catching the focus of researchers from academia, industry, and government. Applying bibliometric method, this paper begins to explore the status of IoT from 1992 to 2015 by locating heading “Internet of Things” as topic in the SSCI database. This paper surveys and classifies IoT articles using the following eight categories – publication year, citation, document type, country/territory, institute name, language, source title and research area – for different distribution status in order to find the difference and how IoT technologies and applications have developed in this period. Furthermore, the paper performs the K-S test to check whether the distribution of author article production of IoT follows Lotka’s law or not. Finally, conclusion and limitation of IoT will be addressed.

Keywords: Internet of Things, IoT, research trend.

INTRODUCTION
The Internet of Things (IoT), also called Internet of Everything [1] or Network of Everything [16], is the network of physical objects or “things” embedded with electronics, software, sensors, and connectivity to enable objects to exchange data with the production, operator and/or other connected devices based on the infrastructure of International Telecommunication Union's Global Standards Initiative [9]. The Internet of Things allows objects to be sensed and controlled remotely across existing network infrastructure [4], creating opportunities for more direct integration between the physical world and computer-based systems, and resulting in improved efficiency, accuracy and economic benefit [2][20]. Each thing is uniquely identifiable through its embedded computing system but is able to interoperate within the existing Internet infrastructure. Experts estimate that the IoT will consist of almost 50 billion objects by 2020 [8].

The term “Internet of Things” was coined by British entrepreneur Kevin Ashton in 1999 [23]. Typically, IoT is expected to offer advanced connectivity of devices, systems, and services that goes beyond machine-to-machine communications [12] and covers a variety of protocols, domains, and applications [7]. The interconnection of these embedded devices (including smart objects), is expected to usher in automation in nearly all fields, while also enabling advanced applications like a Smart Grid [15], and expanding to the areas such as Smart city [10][24].

Things, in the IoT, can refer to a wide variety of devices such as heart monitoring implants, biochip transponders on farm animals, electric clams in coastal waters [14], automobiles with built-in sensors, or field operation devices that assist fire-fighters in search and rescue [22]). These devices collect useful data with the help of various existing technologies and then autonomously flow the data between other devices [3][5]. Current market examples include smart thermostat systems and washer/dryers that utilize Wi-Fi for remote monitoring.

Besides the plethora of new application areas for Internet connected automation to expand into, IoT is also expected to generate large amounts of data from diverse locations that is aggregated very quickly, thereby increasing the need to better index, store and process such data [6][21].

RESEARCH ARCHITECTURE
Applying a bibliometric approach, the paper intends to explore the position of IoT in Taiwan by comparing universal research trends, forecasts and citations from 1992 to 2015 by locating heading “Internet of Things” in topics in the SSCI database. The bibliometric analytical technique was used to examine these two topics in SSCI journals from 1992 to 2015, we found of 65 articles in Taiwan and 1566 articles in universe. This paper surveys and classifies IoT articles between Taiwan and universe using the following eight categories – publication year, citation, document type, country/territory, institute name, language, source title and research area – for different distribution status in order to find the difference and how IoT technologies and applications have developed in this period. Besides, the study investigates the relationship between publications and citations in Taiwan and universe. Furthermore, the paper performs the K-S test to check whether the distribution of author article production of Taiwan and universe follows Lotka’s law or not. Finally, the study will analyze IoT technology trends, forecasts and citations under the above results.

RESEARCH RESULTS
Distribution by Publication Year and Citation
Regarding the relationship between article production and citations in IoT, the citations also follow the article production ranking accordingly in IoT (Figure 1).

Distribution by Country/Territory
According to Figure 2, we can find out that the PRC is at the top with 405 (25.86%) in IoT, followed by US with 375 (23.95%) and England with 138 (8.81%) respectively. Behind them, Spain, Italy, South Korea, and Germany are also major academic providers in the field of IoT. Taiwan ranks No. 8 with 65 (4.15%).

The Fifteenth International Conference on Electronic Business, Hong Kong, December 6-10, 2015
As Figure 3 indicates, it is easy to indicate that the PRC is now the most productive country within the research aspect of IoT.

**Distribution by Document Type and Language**

In Table 1, the distribution of document types from 1992 to 2015 indicates that the most popular publication document type is “Article” (1406 articles, 89.78%). The result demonstrates that the article is the major tendency of document type in IoT research domain. In addition, the majority language for IoT researchers is English with 1527 articles (97.51%). Clearly, English is still the main trend in IoT research domain.

**Distribution by Research Area**

The top three for IoT research domains are computer science (696 articles, 44.44%), followed by telecommunications (466 articles, 29.76%) and engineering (427 articles, 27.27%). Analysis reveals that there are many additional research domains for IoT article production, such as instruments & instrumentation, business economics, chemistry, electrochemistry, physics, automation control systems and information science and library science (Figure 4).
Figure 3. Distribution of top 25 institutions of IoT (source: SSCI database on 2015/08/06)

Table 1. Distribution of document types for IoT (source: SSCI database on 2015/08/06)

<table>
<thead>
<tr>
<th>Language</th>
<th>NP</th>
<th>% of 1566</th>
<th>Document Type</th>
<th>NP</th>
<th>% of 1566</th>
</tr>
</thead>
<tbody>
<tr>
<td>English</td>
<td>1527</td>
<td>97.51%</td>
<td>Article</td>
<td>1406</td>
<td>89.78%</td>
</tr>
<tr>
<td>Spanish</td>
<td>13</td>
<td>0.83%</td>
<td>Editorial Material</td>
<td>91</td>
<td>5.81%</td>
</tr>
<tr>
<td>German</td>
<td>6</td>
<td>0.38%</td>
<td>Proceedings Paper</td>
<td>54</td>
<td>3.45%</td>
</tr>
<tr>
<td>Portuguese</td>
<td>4</td>
<td>0.26%</td>
<td>Review</td>
<td>44</td>
<td>2.81%</td>
</tr>
<tr>
<td>Chinese</td>
<td>3</td>
<td>0.19%</td>
<td>News Item</td>
<td>16</td>
<td>1.02%</td>
</tr>
<tr>
<td>French</td>
<td>3</td>
<td>0.19%</td>
<td>Book Review</td>
<td>4</td>
<td>0.26%</td>
</tr>
<tr>
<td>Dutch</td>
<td>2</td>
<td>0.13%</td>
<td>Correction</td>
<td>3</td>
<td>0.19%</td>
</tr>
<tr>
<td>Swedish</td>
<td>2</td>
<td>0.13%</td>
<td>Book Chapter</td>
<td>1</td>
<td>0.06%</td>
</tr>
<tr>
<td>Turkish</td>
<td>2</td>
<td>0.13%</td>
<td>Discussion</td>
<td>1</td>
<td>0.06%</td>
</tr>
<tr>
<td>Czech</td>
<td>1</td>
<td>0.06%</td>
<td>Meeting Abstract</td>
<td>1</td>
<td>0.06%</td>
</tr>
<tr>
<td>Polish</td>
<td>1</td>
<td>0.06%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slovenian</td>
<td>1</td>
<td>0.06%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Welsh</td>
<td>1</td>
<td>0.06%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>1566</td>
<td>100%</td>
<td><strong>Total</strong></td>
<td>1566</td>
<td>100%</td>
</tr>
</tbody>
</table>

NP = number of publication

**Distribution by Source Title**

The top three IoT research journals are *Sensors* (67 articles, 4.28%), followed by *International Journal of Wireless Personal Communications* (56 articles, 3.58%) and *China Communications* (36 articles, 2.30%). Moreover, it also find out that there are a lot of research sources for IoT article production such as *AD HOC Networks, IEEE Sensors Journal, Wireless Personal Communications, IEEE Transactions on Industrial Informatics, IEEE Internet Computing, Computer and Personal and Ubiquitous Computing* (Figure 5).
Figure 4. Distribution of top 25 research areas of IoT (source: SSCI database on 2015/08/06)

Figure 5. Distribution of top 25 source titles of IoT (source: SSCI database on 2015/08/06)
DISCUSSION

The section implements the steps to verify whether the distribution of author article production follows Lotka’s law in IoT research domain.

1. Collect data and

2. List author & article distribution table

Author quantity is calculated by the equality method from 1566 articles retrieved by the SSCI index. Altogether, 4123 authors on IoT in universe are included. See Table 2 for reference.

3. Calculation the value of n (slope)

In Table 3, we list the number of authors and the number of publications by one author for calculation of the exponent n with topic as “Internet of Things” in SSCI database. The results of the calculations in Table 3 can be brought into the Equation (1) to calculate the value of n:

\[
 n = \frac{30((7.35)-(32.24)(15.48))}{30(39.00)-(32.24)^2}
\]  

Then we can find \( n = -2.36966 \)

Table 2. Calculation of author productivity of IoT

<table>
<thead>
<tr>
<th>NP</th>
<th>Author(s)</th>
<th>(NP) * (Author)</th>
<th>Accumulated Record</th>
<th>Accumulated Record %</th>
<th>Accumulated Author(s)</th>
<th>Accumulated Author(s) %</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>1</td>
<td>30</td>
<td>30</td>
<td>0.55%</td>
<td>1</td>
<td>0.02%</td>
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<tr>
<td>20</td>
<td>1</td>
<td>20</td>
<td>50</td>
<td>0.92%</td>
<td>2</td>
<td>0.05%</td>
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<tr>
<td>18</td>
<td>1</td>
<td>18</td>
<td>68</td>
<td>1.25%</td>
<td>3</td>
<td>0.07%</td>
</tr>
<tr>
<td>11</td>
<td>2</td>
<td>22</td>
<td>90</td>
<td>1.66%</td>
<td>5</td>
<td>0.12%</td>
</tr>
<tr>
<td>10</td>
<td>1</td>
<td>10</td>
<td>100</td>
<td>1.84%</td>
<td>6</td>
<td>0.15%</td>
</tr>
<tr>
<td>9</td>
<td>5</td>
<td>45</td>
<td>145</td>
<td>2.67%</td>
<td>11</td>
<td>0.27%</td>
</tr>
<tr>
<td>8</td>
<td>7</td>
<td>56</td>
<td>201</td>
<td>3.70%</td>
<td>18</td>
<td>0.44%</td>
</tr>
<tr>
<td>7</td>
<td>11</td>
<td>77</td>
<td>278</td>
<td>5.12%</td>
<td>29</td>
<td>0.70%</td>
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<tr>
<td>6</td>
<td>15</td>
<td>90</td>
<td>368</td>
<td>6.77%</td>
<td>44</td>
<td>1.07%</td>
</tr>
<tr>
<td>5</td>
<td>17</td>
<td>85</td>
<td>453</td>
<td>8.34%</td>
<td>61</td>
<td>1.48%</td>
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<td>4</td>
<td>87</td>
<td>348</td>
<td>801</td>
<td>14.74%</td>
<td>148</td>
<td>3.59%</td>
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<tr>
<td>3</td>
<td>125</td>
<td>375</td>
<td>1176</td>
<td>21.64%</td>
<td>273</td>
<td>6.62%</td>
</tr>
<tr>
<td>2</td>
<td>408</td>
<td>816</td>
<td>1992</td>
<td>36.66%</td>
<td>681</td>
<td>16.52%</td>
</tr>
<tr>
<td>1</td>
<td>3442</td>
<td>3442</td>
<td>5434</td>
<td>100.00%</td>
<td>4123</td>
<td>100.00%</td>
</tr>
</tbody>
</table>

NP = number of publication

4. Calculation the value of c

The value of c is calculated by using the Equation (2), where \( P = 20 \), \( x = 1-19 \) and \( n = 2.36966 \), then we can find \( c = 0.71561867 \).

With \( n = -2.36966 \) and \( c = 0.71561867 \), the Lotka’s law equation of IoT is:

\[
 f(x) = 0.71561867/x^{2.36966}
\]  

When the result is compared to Table 2, we can see that authors with only one article account for 83.48% (100%-16.52%=83.48%), which closes to the primitive c value 71.56% generated by Lotka’s law. The values for n and c can be calculated by the least squares law and then brought into further analysis for Lotka’s law compliance.

According to [17], the absolute value of n should be between 1.2 and 3.8, as given by the generalized Lotka’s law. The result indicates that \( n (=2.36966) \) is between 1.2 and 3.8 and is matched the reference data by observation. The detail distribution chart is shown in Figure 6.
Table 3. Calculation of the exponent n for IoT

<table>
<thead>
<tr>
<th>x (NP)</th>
<th>y (Author)</th>
<th>X=log(x)</th>
<th>Y=log(y)</th>
<th>XY</th>
<th>XX</th>
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<tbody>
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<tr>
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</table>

x = number of publication; y = author; X = logarithm of x; Y = logarithm of y

Figure 6. Distribution of literature productivity of author on IoT research aspect

The Fifteenth International Conference on Electronic Business, Hong Kong, December 6-10, 2015
Utilize the K-S test to evaluate whether the analysis matches Lotka’s law. From Table 4, we can find $D = \text{Max} | \text{Fo}(x) - \text{Sn}(x) | = 0.3463$. According to the K-S test, the critical value at 0.01 level of significance is calculated by using the Equation (4):

$$\frac{1.63}{\sqrt{T23}} = 0.02539$$

Table 4. The K-S test for IoT

<table>
<thead>
<tr>
<th>NP</th>
<th>Author(s)</th>
<th>IoT (Observed)</th>
<th>Sn(x)</th>
<th>IoT (Expected)</th>
<th>Fo(x)</th>
<th>D</th>
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NP = number of publication; IoT = author productivity of IoT; Sn(x) = observed cumulative frequency; Fo(x) = theoretical cumulative frequency; D = maximum deviation

**CONCLUSION**

The results in this paper have several important implications. From the distribution of publication year, IoT has more potential to grow up and becomes more popular. The article and English are the main tendency of document type and language in IoT research.

On the basis of the countries/territories, the PRC, the US and England are the top three countries/territories in IoT research. Besides, Spain, Italy, South Korea, Germany and Taiwan are also the major academic article providers in IoT.

Regarding the institutions, analysis of the locations of these affiliations shows that the PRC is now the most productive country within the research aspect of IoT.

Judging from the research area, the most relevant disciplines in IoT research categories provided by computer science, telecommunications, engineering, instruments & instrumentation, physics, chemistry, electrochemistry will become the most...
important categories for IoT researchers.

Based on the sources, the most enthusiastic supports for IoT scholarly publishing enterprise come from AD HOC Networks, IEEE Sensors Journal and Wireless Personal Communications which are repeated in IoT research domain and will turn into the most critical journals for IoT researchers.

According to the K–S test, the result shows that the author productivity distribution of IoT can’t be predicted by Lotka’ law [18]. The reason why IoT does not fit Lotka’s law is the amount of authors who published one article is too large. The result causes that the difference between observed value and expected value becomes greater than the K–S test critical value. The outcome diverges IoT distribution from the slope of Lotka’s law.

According to the analyzing results, this paper provides the IoT roadmap, abstracts technology trend information and facilitates knowledge accumulation for future researches. Therefore, the researches of IoT can follow and concentrate their attentions on the right countries, institutes, research categories and core journals, and create the research potentials in the near future.

Limitation of the Study
The results and conclusion are limited and not intended to be exclusive. SSCI journals adopt stringent journal reviewing criteria, the articles might take one to two years from submission to publication. Besides, the SSCI database does not collect SCI and conference proceedings, the findings in this study may not reflect the most recent research trends. Furthermore, this study used only one search term each (“Internet of Things”) to analyze IoT publications from 1992 to 2015 collected in the SSCI databases. Future studies with greater resources, using more search terms, are needed to expand these findings.

REFERENCES


A CONCEPTUAL MODEL OF FACTORS AFFECTING POPULARITY OF MARKETING VIDEOS ON VIDEO SHARING SITES

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ABSTRACT
Recent studies indicate that 84% of marketers are using video on the websites and 90% of viewers say that watching a video is helpful in the buying decision process. YouTube is one of the most popular free video sharing sites that marketers use to disseminate online video advertisements to their audiences. With this kind of service, video advertisements have a chance to spread more widely than before. Therefore, we are interested in studying the correlation between various factors of video advertisements and the popularity of such video advertisements. In this study, we reviewed prior research as well as other sources on viral factors, popularity of marketing videos, and video sharing sites. Then, we proposed a conceptual model for our future research on the factors that affect the popularity of marketing videos published on video sharing sites. The Interactive Advertising Model (IAM) is adopted as a tool for evaluating the popularity of marketing videos uploaded on video sharing sites.

Keywords: Viral Factors, Marketing Video, Video Sharing Site, Interactive Advertising Model.

INTRODUCTION
Internet advertising is growing closely to TV advertising to become the largest advertising segment. According to PwC, global Internet advertising revenue will increase to US$194.5bn in 2018, a 10.7% CAGR, compared to US$117.2bn in 2013 [25]. Moreover, within Internet advertising, video Internet advertising revenue will have the highest growth at a 23.8% CAGR to 2018, followed by mobiles advertising with a 21.5% CAGR [25]. Therefore, video Internet advertising is a significant marketing platform that businesses should be focusing on.

Among video sharing sites, YouTube ranked as the most popular site with 152.8 million unique viewers, followed by Facebook with 83.5 million viewers, Yahoo Sites with 55.4 million, Maker Studios Inc. with 43.7 million and VEVO with 43.1 million [6]. The emerging of such video sharing sites give a great opportunity to businesses to broadcast marketing videos about their new products/services or just convey messages to engaging with their consumers for free. That is why more and more businesses consider uploading their marketing videos on video sharing sites, especially YouTube, as an important marketing campaign. However, one of the most challenges in launching a marketing video on such websites is how to make it a popular video or in other words a viral video.

Viral video is a video that becomes popular from the process of sharing and re-sharing on Internet, e.g. social sites, blogs and email. In addition, the sharing process of viral videos must be unpaid and occurred from consumer to consumer, not from advertiser to consumer, as they perceived likeability, controversial and entertainment characteristics from videos [3] [18] [23]. Many videos got traction from massive viewers and were enlisted to be viral videos. Some of these videos were also ranked by YouTube in the most viewed of all time playlists [31] even though they were published many years ago. One example is PSY – GANGNAM STYLE which is a music video published on July, 2012, and so far has got a total view count of 2.3 billion and still ranked in the first place of the list until now. In previous studies, Chatzopoulou, Sheng and Faloutos had analyzed the popularity in YouTube using roughly 37 millions videos. They found that viewcount, number of comments, number of ratings and number of favorites are highly correlated [4]. Feroz Khan and Vong also found that when viewcount were increasing, the number of likes were also rise up too. Surprisingly, the number of comments were found to strongly relate to the number of dislikes [12]. This is interesting that going viral may not always good for video owner.

The research question of this study are “What are the factors that make marketing videos go viral?” and “How viral marketing video with its features affect consumer responses?” This study is going to find some clues for this question by reviewing findings and guidance from both previous academic researches and practitioners’ suggestions. Then, a conceptual model is proposed for this study.

RESEARCH OBJECTIVES
The objective of this study is to articulate a conceptual model of factors affecting video popularity and its influences on consumer responses.

LITERATURE REVIEW
In this study, we use the term viral factors as the factors that affect the popularity of videos. Due to our exploration from both academic researches and practitioners’ suggestions, there are many factors that should be considered when creating a viral video.
marketing video. However, we classified these factors into three main categories which are video metadata, emotion, and video content. Our investigation were summarized as follows.

The first category of viral factors is video metadata. There were 3 factors in this category that received attention which are video title length, video length, and published day. In West’s study, he found that the average length of the 20 viral videos from TimeMagazine’s popular video list was 2:47 minutes [30]. This time length of the viral videos was also consistent with the finding by Jiang, Miao, Yang, Lan, and Hauptmann which they studied on a larger set of viral videos, 446 viral videos in total [18]. They found that most viral videos have shorter duration, 2:18 minutes on average, while the videos in quality group and background group were more than 4 minutes length on average. For video title length, West found that that viral videos had around 3 words [30]. While Jiang, Miao, Yang, Lan and Hauptmann found that viral videos had around 5 words [18]. There was a story which recommended what were the perfect days to upload a video. According to the study by Gill, Arlitt, Li, and Mahanti, they analyzed Internet traffic on YouTube. Their work showed some interesting information that “people usually go watching videos on weekday more than weekend” [14]. The most fraction is on Thursday, followed by Wednesday. Cheng recommended to release video on Monday or Tuesday, that are also weekday[5].

The second category of viral factors is emotion. The effect of emotions on video is also important. Many studies found that the audiences whose emotions were highly aroused after watching the video will had intention to share those videos more than the others who experienced low arousal emotions. Among those who had high arousal emotions, positive emotions such as hilarity and astonishment seemed to have more effect on sharing intention than the negative emotions like sadness [22]. Some specific emotions such as happiness, funny, surprise, scary, sadness and anger found more in viewers who intended to share or already shared when compared to those who did not share [17]. Teixeira analyzed facial expression to reveal the feeling of the viewers when they were watching advertising videos [28]. According to his finding, he suggested techniques that can help commercial video to be watched and shared. For examples, he found that the video advertisements which contained nudity content aroused shock emotions. Even if the viewers who felt shock may watch the video to its end, they did not share those videos. So, the videos should make viewers feel surprise but not shock in order to make them to be shared. Dobele, Lindgreen, Beverland, Vanhamme and Van Wijk analyzed the influence of six primary emotions including joy, surprise, angry, disgust, and sadness on sharing. In their finding, element of surprise need to be in viral message and should be mixed with other emotions [7]. The other perspective of emotions used in video content is emotional tone which are pleasant, coactive, and unpleasant. Eckler & Bolls [9] used this definition in their observations. They found that the video with pleasant emotional tone evoked the most positive attitude toward the advertising video followed by coactive state and unpleasant respectively. Moreover, they also found the same impact of emotional tone on attitude toward brand. In addition, pleasant emotional tone let viewer intent to forward the most followed by coactive emotional and unpleasant emotional consequently [9]. Furthermore, attitude toward viral video advertisement is a major factor affecting video sharing [16] and those videos need to make viewer like enough to make them share [23]. Concerning how to measure emotions, there are two major methods which are explicit method and implicit method. The explicit method is based on asking the samples directly about the emotions they experienced by using different kind of tools such as scales, cartoon-like pictures and so on. This methods can be used to assess subjective feeling regarding experienced emotions. Whereas the implicit method is used to assess autonomic reaction when the participants are given the stimuli [8]. The implicit method also has many tools including analysis of facial expression. Ekman classified basic emotions into six major emotions: anger, happiness, surprise, disgust, sadness, and scare [10]. He used these basic emotions in his facial expression analysis study [10].

The last category of viral factors is video content. There is no concrete concept about how to design video content to be viral. However, there were some suggestions of how the content should be. According to Miller, there were three most common characteristics of videos which were used to promote brands and products: informative, educational and entertaining [19]. For the first characteristic, informative, the videos that have this characteristic are the ones that provide useful information for viewers, something which they are looking for or something that help them make some decisions. The information from this video may be introduction of a new product or even the company situations. For example, tourism industry may produce a video that provides information about the featured destination or comparing the cost to different destinations. The second characteristic is educational which is a video that helps educate the viewer how to do something useful step-by-step. The videos that has this characteristic is often called “how to” video. Berger and Milkman studied educational characteristic in online newspaper. Their result also confirmed that consumer tended to share useful practical content due to some reasons such as to help others or for self enhancement [1]. The final characteristic of videos is entertaining. They are videos that have to have something interesting and humorous.
Furthermore, there are many others suggestion from websites that practitioners wrote about how to make a successful video. For example, wikiHow recommended many tips such as video should begin with basic to advance ideas, follow the popular trend, show off an amazing talent, using funny or cute animal, and make a music video. Golan and Zaidner investigated content of 360 viral advertisments to identify the main advertising appeals. They found that humor was by far the most commonly used in advertising as it took 91% of the ads, followed by sexuality, animals, violence and children respectively [15] Sirripyavatana and Sutheerawong studied the effect of advertising technique called Prankvertising on consumer behavior [27]. The Prankvertising aims to create a phenomenon of viral marketing by playing prank on target which were set up by company and then these events were recorded and shared over the Internet. They found that using Prankvertising together with a particular emotion will lead to different consumer buying decision. Caring emotion which contains friendliness and love affected the highest degree on willingness to buy, while negative and forceful emotion discouraged buying decision the most.

Violations are threats such as insult, not wearing pants, attacks and so on. Surprisingly, using violation content concurrently seems benign, the extent to which it seems okay, will made that content looks humor and will be shared [29]. Moreover, using higher levels of violence in humorous video advertising also resulted in better retention of brand and greater involvement with the video message while attitudes toward the brand remain the same [2]. In addition, provocative content like sexuality and violence is used in many viral videos compared to television advertising [24]. However, the use of sexuality in videos was not recommended as viewers will not share it even if they like it [28]. The use of images of youths especially females has become a trend in advertising even if it is not related to their products or services. This technique is considered to be sex advertising which aims to attract attention from viewers. The sex advertising is one that uses nude images of women or girls as sex appeal. However, there is no ethical basis for this characteristic being used in advertising. In addition, using of sexuality is not recommended even if it is able to attract viewers but it does not mean viewers will like the product [20].

Using of cuteness in video media is also interesting to be considered. The presence of children in advertisements has become a new trend in Malaysia’s advertising industry. Murad, Saahar, Halim studied the children portrayal in press advertisement and found that various industries, not only in children products or services industries, are using children as their selling strategy [21]. Moreover, portraying loving children creates an emotional appeal. Roller babies Evian which was suggested by Miller is presented in Figure 1 (left) is a good example video that has entertaining characteristic and also use a cuteness of children. Furthermore, there were many videos using animal moments that became viral and presented in both commercial and non-commercial videos. THE DOG, a commercial video in banking industry in Thailand, was just uploaded on May 18, 2015 and so far attracted more than 6.0 million viewers. Even though the language used in THE DOG is Thai language, it attracted viewers from around the world. A snapshot from THE DOG videos can be seen in Figure 1 (right).

**Viral Measurement**

In previous study, there were many attempts in creating a formula to claim whether a video is a viral video. Figueiredo, Benevenuto, and Almeida used the views at peak day and its total views to classify the video into three groups, namely viral, quality and background [13]. Their formula was then tested by Jiang, Miao, Yang, Lan, and Hauptmann with many viral videos, including PSY-GANGNAM STYLE, but the result showed that those videos were not categorized in the viral group [18]. Another study by Google’s researchers defined the term of viral video as the popular video with at least 60% of views in the first month from social sources like watching a video from blogs, clicking on a video link in emails, and so on [3]. However, the information is not available to outside researchers. There are other test for checking if it a viral videos or not. Jiang, Miao, Yang, Lan, & Hauptmann used viral videos from three sources, Time Magazine’s popular videos, YouTube Rewind 2010-2012 and Equal Three Episodes. In their finding, the correlation between the number of documents returned from Google search engine and the number of views in viral video group were more than twice of the other two groups which are quality and background [18]. The finding shows that these correlations can be used as the socialness as defined by Broxton, Interian, Vaver, and Wattenhofer [3]. However, from practitioners perspective, there are arguments among agencies that how much views needed to be a viral successful. 27.8% of them voted that more than one million views needed to be a successful viral video while there are equally 22.2% of them consider 100,000 views, 250,000 views and 500,000 views as a successful viral video. Only an even percentage of respondents
which are 2.8% voted for 25,000 views and 50,000 views [11].

Interactive Advertising Model
Rodgers and Thorson proposed the Interactive Advertising Model (IAM) to provider an integrative processing model of Internet advertising which incorporates the functional and structural schools of thought [26]. This model offers a broad scheme to classify most Internet ads and a number of common features unique to these ads. It contains three parts. The first part considers consumer motive in Internet uses and information process related to prior attention, memory and attitude before interacting with the ads. The second part describes advertising structure and consumer responses is the final part. The IAM shown in Figure 2.

The IAM model are suitable for most online advertising by representing a whole process of how Internet user interact with online ads. Firstly, the consumer-controlled describe the motive of Internet user when they utilize the Internet. These Internet motives also come with mode which are serious or playful and the mode can changed during their Internet activities. For example, someone who looking for stuff on the Internet with playful mode may changes to serious mode when they found an item they interest. However, there are many advertising on the Internet. Thus, Internet users may experience some online ads during their Internet use and then process those ads using cognitive tools, which are attention, memory and attitude, before making some responses toward the ads. Secondly, The IAM presented structures of the ads in interactive environment which seems as a stimulus that affect consumer responses. The structures are consist of ad types, ad format and ad features. Finally, after Internet users process information towards online ads they found, they then give some responses to it. Even if Internet users ignore the ads, it is also counted as a consumer response.

Figure 2. Interactive Advertising Model (IAM) by Rodgers and Thorson (2000)
CONCEPTUAL MODEL

In our study, we considered marketing videos as one kind of Internet advertisings because Internet users may find these kind of videos during their Internet activities. Then, they may watch the video and give respond to it. Given this background we applied the IAM to our study based on the ads structures part and the outcomes part because it enough to answer the research questions. The conceptual model adapted from IAM was shown in Figure 3.

![Figure 3. A conceptual model of factor affecting the popularity of marketing video on video sharing sites, which is adapted from the Interactive Advertising Model (IAM)](image)

As a study aim for analysis the factor affecting the popularity of video on video sharing site. Therefore, video types in our study, which adapted from ads type in original IAM, is video popularity. The video popularity may categorized into high and low popularity marketing videos or be a continuous variable. Moreover, it excluded ads type which were categorized by IAM because their features are not related to the objective of this investigation. We did not include video formats in our model because we only study on one format which is video. Concerning video features which were classified into two main categories: objective features and subjective features. In this investigation, we decided that video metadata, for example title length, duration and published day, and video content are objective features while emotion are subjective features. The different between our conceptual model and the original IAM was shown in Table 1.

Table 1. A comparison of the original IAM and the conceptual model of factor affecting the popularity of marketing video on video sharing sites.

<table>
<thead>
<tr>
<th>No.</th>
<th>Interactive Advertising Model (IAM) By Rodgers and Thorson</th>
<th>Conceptual model of factor affecting the popularity of marketing video on video sharing sites.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Consist of ad types, ad formats and ad features</td>
<td>Consist of video types and video features. The video types are representative of ads types and video features are representative of ads features.</td>
</tr>
<tr>
<td>2.</td>
<td>Ads types include: Product/Service, PSA, Issue, Corporate, Political</td>
<td>Video types are classified by popularity of marketing video.</td>
</tr>
<tr>
<td>3.</td>
<td>Ads features are classified into objective and subjective.</td>
<td>Video features are classified into video metadata (e.g. duration, title length, and published day), video content (e.g. children, animal, and prank) and emotion (e.g. humor, sad, and surprise).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The video metadata and the content are considered to be objective features while emotion as a subjective feature.</td>
</tr>
<tr>
<td>4.</td>
<td>Consist of many consumer responses. For example forget/ignore the ad, attend to the ad, form attitude toward the ad, click on ad, explore the website, e-mail the advertiser and purchase the product.</td>
<td>Focus only sharing intention, attitude toward video and attitude toward brand which were investigated the most in previous viral video studies.</td>
</tr>
</tbody>
</table>

LIMITATIONS

There is no appropriate measure for classifying a video into viral or non-viral marketing video because it is various from many perspective as Feed Company did surveyed with executives from the top US creative ad agencies and media buying firms [11]. Moreover, according to viral video definition, which is a video that becomes popular through the process of internet sharing, we cannot follow its entire characteristics because we cannot collect view sources of videos. Moreover, there are many websites that posted viral marketing videos with just thousands of views, not a million. Therefore, we use high or low popular marketing video instead of viral or non-viral marketing video. Another major limitation is that there are many viral marketing videos around the...
world and these videos use different languages. As a conceptual of this study presented consumer responses, the result may be biased due to language barrier.

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A MULTI-OBJECTIVE CLOSED-LOOP SUPPLY CHAIN PLANNING MODEL WITH UNCERTAINTY
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ABSTRACT
Due to the topics such as the environmental issues, the governments’ legislation, natural resource limitations have attracted attention, the research of closed-loop supply chain is increasingly important. Effectively integrated management of a closed-loop supply chain can be a challenge for companies. Companies not only have to meet the environmental regulations, but also have to sustain high-quality supply chain operations as a means to stay competitive advantages and the profit capability. This study proposes a multi-objective mixed integer programming model for an integrated closed-loop supply chain network to maximize the profit, the amicable production level and the quality level. To our knowledge, this proposed model is the first effort to take economic factors, environmental factors, quality factors and uncertain parameters into account simultaneously, and can be a reference for supporting effectively integrated management of a closed-loop supply chain network.

Keywords: Closed-loop supply chain, uncertainty, multi-objective mixed integer programming model.

INTRODUCTION
A closed-loop supply chain is integrated with a forward supply chain and a reverse supply chain [3]. For the increasing environmental turbulence and more intense competitive pressures, the integration of forward and reverse supply chains to gain more productivity and customer satisfaction becomes important for companies to keep sustainable competitive advantages [10]. Besides, designing integrated forward-reverse supply chain networks is highly recommended to avoid the sub-optimality arising from the separate design of forward and reverse networks [5][6][10]. Due to the increased environmental concerns, government legislations, awareness of natural resource limitations in worldwide, social and economic factors, a closed-loop supply chain has attracted growing attention among both academia and practitioners [2][13].

Although the environmental supply chain design is a very important and complex decision that forms in a dynamic and uncertain environment [8][9], there are only few researches trying to work on green and sustainability subjects in view of integrated reverse logistics and closed-loop supply chains [2]. In order to gain competitive advantages, companies not only have to meet the environmental regulations, but also have to maintain high quality of the supply chain as a means to stay in business over their lifetime. The quality level is one of the appropriate performance measures to determine efficiency and/or effectiveness of a company’s supply chain system [12]. This study formulates a supply chain network model simultaneously considering amicable production for environmental protection and high-quality supply chain management.

As real world problems are usually complicated and involve multi-faceted issues, the performance of the supply chain network design is only measured by an economic factor, namely cost minimization or profit maximization, is not realistic [12]. It is necessary for researchers to pay more attention to multiple objective functions [2]. This study proposes a multi-objective mixed-integer linear programming model of the closed-loop supply chain network with three objective functions including maximizing the profit, the amicable production level and the quality level. As for the stochastic nature of demand and return, this proposed mathematical model considers uncertain demand and return. The rest of the paper is organized as follows. Section 2 reviews relevant literature. Section 3 is devoted to the proposed multi-objective mixed-integer linear programming model. Conclusions are discussed in section 4.

LITERATURE REVIEW
Guide & Van Wassenhove [3] used the business view to define closed-loop supply chain management as the design, control, and operation of a system to maximize value creation over the entire life cycle of a product with dynamic recovery of value from different types and volumes of returns over time. Based on environmental, legal, social, and economic factors, closed-loop supply chain issues have attracted attention by the evidence of many publications in scientific journals which have been published in recent years [2].

From reviewing the relevant literatures, it can be found that multiple objectives should be considered in the design of a closed-loop supply chain to maximize value creation of the whole supply chain ecosystem [3][11]. The supply chain network should be designed in a way that it could handle the uncertainty of parameters; otherwise the impact of uncertain parameters will be larger than necessary [10].

Amin & Zhang [1] proposed a multi-objective facility location model for a closed-loop supply chain under uncertain demand and return. A mixed-integer linear programming model is utilized that minimizes the total cost and maximizes the environmental parameters such as friendly materials and clean technology. The model also is developed by stochastic programming (scenario-based) to examine the effects of uncertain demand and return on the network configuration.
Pishvae & Razmi [9] proposed an environmental supply chain network design using multi-objective fuzzy mathematical programming model. The two objective functions of the proposed model are minimization of total cost and total environmental impact. Alife cycle assessment-based (LCA-based) method is applied to assess and quantify the environmental impact of different options for supply chain network configuration. Besides, an interactive fuzzy approach is developed and a real industrial case is investigated to assess the effectiveness of the proposed model and the usefulness of the proposed solution approach.

Ramezani, Bashiri, & Tavakkoli-Moghaddam [12] formulated a multi-objective stochastic model for a forward-reverse logistic network design considering the responsiveness level and the quality level under an uncertain environment. The objectives are to maximize the total profit, the customer service level and minimize the total number of raw material defects obtained from suppliers for increasing the sigma quality level. Ramezani et al. [11] designed a multi-product, multi-period, closed-loop supply chain network with three objective functions: profit maximization, delivery time minimization, and quality maximization. A fuzzy optimization approach is utilized considering incomplete or imprecise information in data and the flexibility of constraints.

As summarized above, there is a research gap for building a closed-loop supply chain network model simultaneously taking economic factors, environmental factors, quality factors and uncertain parameters into account. This study proposes a multi-objective mixed-integer programming model with uncertain demand and return to maximize the total profit, the amicable production level, and the quality level.

**MODEL FORMULATION**

**Problem Definition**

This study considers a single-period, multi-product, multi-echelon closed-loop supply chain network, including four layers in the forward supply chain network (i.e. suppliers, plants, distribution centers, customers) and four layers in the reverse supply chain network (i.e. customers, collection centers, remanufacturing centers and disposal centers).

In the forward supply chain flow, the suppliers offer the raw materials to plants. The new products are shipped from plants to distribution centers. The distribution centers then distribute the new products to customers to meet the customer demand. In the reverse supply chain flow, the returned products from customers are shipped to collection centers for inspection. After being inspected in the collection centers, the reusable products are shipped to the remanufactured centers and the disposable products are shipped to the disposal centers. The reused materials in the remanufactured centers are shipped to the plants for producing new products and the disposable parts are shipped to the disposal centers. The structure of the proposed closed-loop supply chain network is illustrated in Fig. 1.

![Fig.1 the proposed closed-loop supply chain network](Image)

The following assumptions are made in the network configuration:

1. The model is designed for a single-period.
2. Locations of suppliers and customers are known and fixed.
3. Locations of plants, distribution centers, collection centers, remanufactured centers and disposal centers are known.
4. The capacity of plants, distribution centers, collection centers, remanufactured centers and disposal centers are restricted.
5. The quantity of demand and return are uncertain.
6. The inventory issue is not considered.

**Model Description**

To describe the aforementioned supply chain network, the following indices, parameters, decision variables are used in the model formulation:

Indices:
- $S$ index of fixed locations of suppliers, $S=1,2,…,S$
- $C$ index of fixed locations of customers, $C=1,2,…,C$
- $P$ index of potential locations of plants, $P=1,2,…,P$

**FORMULATION**

**DEFINITION**

∈ Indices:
- $S$ index of fixed locations of suppliers, $S=1,2,…,S$
- $C$ index of fixed locations of customers, $C=1,2,…,C$
- $P$ index of potential locations of plants, $P=1,2,…,P$
Parameters:

- $SC_{rs}$: purchasing cost of raw material $r$ from supplier $s$
- $PC_{pj}$: production cost of product $j$ from plant $p$
- $RC_{mj}$: remanufactured cost of product $j$ from remanufacturing center $m$
- $CC_{jl}$: inspection and collection cost of product $j$ from collection center $l$
- $DC_{o}$: disposal cost from disposal center $o$
- $FC_{p}$: fixed cost for opening the plant $p$
- $FC_{m}$: fixed cost for opening the remanufacturing center $m$
- $FC_{d}$: fixed cost for opening the distribution center $d$
- $FC_{l}$: fixed cost for opening the collection center $l$
- $FC_{o}$: fixed cost for opening the disposal center $o$
- $TC_{pdj}$: unit transportation cost for product $j$ shipped from plant $p$ to distribution center $d$
- $TC_{dcl}$: unit transportation cost for product $j$ shipped from distribution center $d$ to customer $c$
- $TC_{clj}$: unit transportation cost for product $j$ shipped from customer $c$ to collection center $l$
- $TC_{mlj}$: unit transportation cost for product $j$ shipped from collection center $l$ to remanufacturing center $m$
- $TC_{oj}$: unit transportation cost for product $j$ shipped from collection center $l$ to disposal center $o$
- $TC_{mpr}$: unit transportation cost for reused material $r$ shipped from remanufacturing center $m$ to plant $p$
- $TC_{nor}$: unit transportation cost for scrapped material $r$ shipped from remanufacturing center $m$ to disposal center $o$
- $CS_{sr}$: capacity of supplier $s$ for raw material $r$
- $CP_{pj}$: capacity of plant $p$ for product $j$
- $CM_{mj}$: capacity of remanufacturing center $m$ for product $j$
- $CD_{dj}$: capacity of distribution center $d$ for product $j$
- $CL_{lj}$: capacity of collection center $l$ for product $j$
- $CO_{lj}$: capacity of disposal center $o$ for product $j$
- $CP_{pr}$: capacity of plant $p$ for material $r$
- $CO_{or}$: capacity of disposal center $o$ for material $r$
- $DP_{cj}$: demand of customer $c$ for product $j$
- $RP_{cj}$: return of customer $c$ for product $j$
- $DF_{j}$: minimum of disposal fraction of product $j$
- $P_{jc}$: unit price of product $j$ to customer $c$
- $EM_{pj}$: the ratio of using environmental materials by plant $p$ for product $j$
- $CT_{lj}$: the ratio of using clean technology by collection center $l$ for product $j$
- $DR_{rs}$: defect rate of raw material from suppliers $s$
- $Wr$: weight factor for importance of raw material $r$

Decision variables:

- $QR_{oj}$: quantity of raw material $r$ offered from supplier $s$ for product $j$
- $QP_{pc}$: quantity of product $j$ produced by plant $p$ for customer $c$
- $QD_{pd}$: quantity of product $j$ shipped from plant $p$ to distribution center $d$
- $QC_{plc}$: quantity of product $j$ shipped from distribution center $d$ to customer $c$
- $QL_{cl}$: quantity of returned product $j$ shipped from customer $c$ to collection center $l$
- $QO_{cl}$: quantity of returned product $j$ shipped from collection center $l$ to disposal center $o$
- $QM_{clm}$: quantity of returned product $j$ shipped from collection center $l$ to remanufacturing center $m$
- $QR_{m}$: quantity of reused material $r$ made by remanufacturing center $m$ to plant $p$
- $QRO_{mo}$: quantity of scrapped material $r$ shipped from remanufacturing center $m$ to disposal center $o$
- $IP_{pc}$: 1 if plant $p$ is opened, otherwise 0
- $ID_{dj}$: 1 if distribution center $d$ is opened, otherwise 0
- $IL_{lj}$: 1 if collection center $l$ is opened, otherwise 0
- $IM_{mk}$: 1 if remanufacturing center $m$ is opened, otherwise 0
- $IO_{a}$: 1 if disposal center $a$ is opened, otherwise 0
Objective functions

The goal of this proposed multi-objective closed-loop supply chain model is to optimize resource allocation for attaining the three objectives: maximizing the total profit, the amicable production level and the quality level. The environmental parameters such as friendly materials and clean technology are utilized for the amicable production level which is referenced by Amin & Zhang [1]. The defect rate of raw materials is utilized for the evaluation of the quality level which is referenced by Ramezani, Bashiri, & Tavakkoli-Moghaddam [12].

Max ob1 = Revenue – Purchase Cost – Processing Cost – Transportation Cost – Disposal Cost

Revenue = \( \sum_{i=1}^{I} \sum_{p=1}^{P} \sum_{c=1}^{C} QP_{pc} \times P_{f} \)  

Purchase Cost = \( \sum_{r=1}^{R} \sum_{s=1}^{S} \sum_{f=1}^{F} SC_{rs} \times QR_{rsf} \)  

Processing Cost = \( \sum_{p=1}^{P} FC_{p} \times IP_{p} + \sum_{m=1}^{M} FC_{m} \times IM_{m} + \sum_{i=1}^{I} FC_{i} \times IL_{i} + \sum_{j=1}^{J} \sum_{l=1}^{L} SC_{j} \sum_{c=1}^{C} PC_{jc} \times QP_{jpc} + \sum_{j=1}^{J} \sum_{l=1}^{L} SC_{j} \sum_{c=1}^{C} RC_{jm} \times QM_{jcm} + \sum_{j=1}^{J} \sum_{l=1}^{L} SC_{j} \sum_{c=1}^{C} CC_{jl} \times QL_{jlc} \)  

Transportation Cost = \( \sum_{d=1}^{D} FC_{d} \times ID_{d} + \sum_{j=1}^{J} \sum_{l=1}^{L} SC_{j} \sum_{c=1}^{C} TC_{dj} \times QD_{jpd} + \sum_{j=1}^{J} \sum_{l=1}^{L} SC_{j} \sum_{c=1}^{C} TC_{dj} \times QL_{jdl} + \sum_{j=1}^{J} \sum_{l=1}^{L} SC_{j} \sum_{c=1}^{C} TC_{jcm} \times QM_{jcm} + \sum_{j=1}^{J} \sum_{l=1}^{L} SC_{j} \sum_{c=1}^{C} TC_{jml} \times QM_{jml} + \sum_{r=1}^{R} \sum_{s=1}^{S} SC_{rs} \sum_{f=1}^{F} QC_{rsf} \times QRO_{rsf} \)  

Disposal cost = \( \sum_{d=1}^{D} FC_{d} \times ID_{d} + \sum_{r=1}^{R} \sum_{s=1}^{S} SC_{rs} \sum_{f=1}^{F} DC_{d} \times QRO_{rs} + \sum_{j=1}^{J} \sum_{l=1}^{L} SC_{j} \sum_{c=1}^{C} DC_{j} \times QRO_{jlo} \)  

Max ob2 = \( \sum_{j=1}^{J} \sum_{l=1}^{L} SC_{j} \sum_{c=1}^{C} EM_{j} \times QP_{jpc} + \sum_{j=1}^{J} \sum_{l=1}^{L} SC_{j} \sum_{c=1}^{C} CT_{ij} \times QL_{jdl} + \sum_{j=1}^{J} \sum_{l=1}^{L} SC_{j} \sum_{c=1}^{C} QM_{jcm} + \sum_{j=1}^{J} \sum_{l=1}^{L} SC_{j} \sum_{c=1}^{C} QL_{jlc} \)  

Min ob3 = \( \sum_{r=1}^{R} \sum_{s=1}^{S} SC_{rs} \sum_{f=1}^{F} DR_{rs} \times WR_{r} \times QR_{rsf} \)  

The first objective function is to maximize the total profit which is computed by subtracting purchase cost, processing cost, transportation cost from total revenue. The purchase cost is for purchasing raw materials from suppliers to produce products. The processing cost is for producing products by plants, inspection and collection of returned products by collection centers, processing returned products by remanufacturing centers. The transportation cost is for shipping products or reused materials between facilities in the proposed supply chain network. The disposal cost is for disposing scrapped products or materials by disposal centers. The second objective function is to maximize the amicable production level using the environmental parameters such as friendly materials or clean technology. The third objective function is to maximize the quality level by minimizing the defect rate of raw materials from suppliers.

Constraints

\( \sum_{p=1}^{P} QP_{jpc} \geq DP_{cj} \quad \forall c, j \)  

\( \sum_{i=1}^{I} SC_{i} \sum_{c=1}^{C} QO_{jlo} \leq \sum_{c=1}^{C} RP_{j} \times DF_{j} \quad \forall j \)  

\( \sum_{r=1}^{R} QR_{rsf} \leq CS_{rs} \quad \forall r, s \)  

\( \sum_{c=1}^{C} SC_{j} \sum_{c=1}^{C} QP_{jpc} \leq IP_{p} \times \sum_{p=1}^{P} CP_{pj} \quad \forall p \)  

\( \sum_{i=1}^{I} SC_{i} \sum_{c=1}^{C} QM_{jcm} \leq IM_{m} \times \sum_{i=1}^{I} SC_{i} \sum_{c=1}^{C} CM_{cm} \quad \forall m \)  

\( \sum_{p=1}^{P} SC_{j} \sum_{c=1}^{C} QD_{jpd} \leq ID_{d} \times \sum_{i=1}^{I} SC_{i} \sum_{c=1}^{C} CD_{d} \quad \forall d \)  

\( \sum_{c=1}^{C} SC_{j} \sum_{c=1}^{C} QL_{jdl} \leq IL_{i} \times \sum_{i=1}^{I} SC_{i} \sum_{c=1}^{C} CL_{cj} \quad \forall l \)  

\( \sum_{c=1}^{C} SC_{j} \sum_{c=1}^{C} QO_{jlo} \leq IO_{o} \times \sum_{i=1}^{I} SC_{i} \sum_{c=1}^{C} CO_{oj} \quad \forall o \)  

\( \sum_{m=1}^{M} SC_{r} \sum_{c=1}^{C} QM_{jcm} \leq IP_{p} \times \sum_{r=1}^{R} CP_{pr} \quad \forall p \)  

\( \sum_{m=1}^{M} SC_{r} \sum_{c=1}^{C} QM_{jcm} \leq IO_{o} \times \sum_{r=1}^{R} CO_{or} \quad \forall o \)  

\( \sum_{p=1}^{P} SC_{j} \sum_{c=1}^{C} QD_{jpd} = \sum_{s=1}^{S} SC_{rs} \sum_{f=1}^{F} QC_{rsf} \quad \forall d, j \)  

\( \sum_{d=1}^{D} SC_{j} \sum_{c=1}^{C} QL_{jdl} \geq \sum_{l=1}^{L} SC_{j} \sum_{c=1}^{C} QL_{jlc} \quad \forall c, j \)  

\( \sum_{c=1}^{C} SC_{j} \sum_{c=1}^{C} QM_{jcm} = \sum_{c=1}^{C} SC_{j} \sum_{c=1}^{C} QO_{jlo} + \sum_{m=1}^{M} SC_{j} \sum_{c=1}^{C} QM_{jcm} \quad \forall j \)  

\( QR_{rsf}, QP_{jpc}, QD_{jpd}, QC_{jds}, QL_{jdl}, QO_{jlo}, QM_{jcm}, QM_{jcm} \geq 0 \quad \forall r, s, p, c, d, m, o, l \)  

\( IP_{p}, ID_{d}, IL_{i}, IM_{m}, IO_{o} \in \{0,1\} \quad \forall p, d, m, o, l \)
Constraint (9) ensures that the quantity of each product produced for each customer is greater than the demand. Constraint (10) shows that, for each product, the flow exiting from each collection center to disposal centers is equal to the flow of returned products from customers multiplied by the disposal ratio. Constraint (11) ensures that the sum of each raw material offered from each supplier to plants does not exceed the capacity of this supplier. Constraint (12) states that the sum of each product produced for customers by each plant does not exceed the capacity of this plant. Constraint (13) presents that the sum of each returned product processed by each remanufacturing center from collection centers does not exceed the capacity of this remanufacturing center. Constraint (14) states that the sum of each product shipped to customers from each distribution center does not exceed the capacity of this distribution center. Constraint (15) presents that the sum of each returned product inspected or collected by each collection center from customers does not exceed the capacity of this collection center. Constraint (16) ensures that the sum of each scrapped product disposed by each disposal center from collection centers does not exceed the capacity of this disposal center. Constraint (17) states that the sum of each material offered from remanufacturing centers for producing products does not exceed the capacity of this plant. Constraint (18) ensures that the sum of each material shipped from remanufacturing centers for disposal does not exceed the capacity of this disposal center. Constraint (19) represents that, for each product, the flow entering each distribution center from all plants is equal to the sum of the flow exiting from each distribution center to customers. Constraint (20) shows that the sum of each product shipped to each customer is greater than the sum of each product returned from this customer. Constraint (21) represents that, for each returned product, the flow entering each collection center from all customers is equal to the sum of the flow exiting from each collection center to disposal centers and remanufacturing centers. Constraint (22) preserves the non-negativity restriction on the decision variables, and constraint (23) imposes the binary restriction on the decision variables.

Solution Approach

In order to solve the multi-objective problem, this study will utilize weighted sums method and $\varepsilon$ -constraint method to transform our multi-objective optimization problem to mono-objective optimization problem. In the weighted sums method, objective functions are combined by assigning appropriate weights, which can be determined by decision makers. In the $\varepsilon$ -constraint method, the objective function with high priority is considered as objective function and the other objective functions are considered as constraints with allowable bounds [7].

Uncertainty of demand and return in the proposed model will be handled via a robust optimization approach. The solution of the model is ‘robust feasible’ if it remains feasible in response to all possible realizations of the uncertain parameters within their uncertainty bound. In addition, the solution of the model is ‘robust optimal’ if there is no other robust feasible solution with a better objective function value from the objective function of the robust optimal solution [4].

CONCLUSIONS

In order to gain competitive advantages, companies not only have to meet the environmental regulations, but also have to sustain high-quality supply chain operations as a means to stay in business over their lifetime. This study proposes a multi-objective model for an integrated closed-loop supply chain network, which simultaneously takes economic factors, environmental factors and quality factors and uncertain parameters into account to maximize the profit, the amicable production level and the quality level. Considering the multiple objectives in the closed-loop supply chain help companies obtain more precise information to make better decision. The proposed mathematical model can be a reference for supporting effectively integrated management of the closed-loop supply chain network, and thus contribute to the academia and practices.

REFERENCES


A NEW INNOVATIVE IOT WATCH REDUCES EXCESSIVE CONSUMPTION AND ITS IMPLICATIONS TO GREEN LOGISTICS
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ABSTRACT
Excessive consumption leads to 7 trends of crises, including destruction of the atmosphere, energy crisis, social decline and conflicts. Over consumption also deteriorates human health. To reduce excessive consumption not only can improve health, it can also reduce transportation from consumption, livestock raise and sale, and medical care. The reducing over consumption can benefit human health and environmental protection through supply chain management. This motivates us to devise an innovative product. Our imaginative innovative product is a new smart watch (SW) which improves several new features based on Apple Watch. After a survey to potential users, it reveals that the new features can help reduce the excessive consumption, deterioration of the human health, transportation, healthcare as well as the destruction of the environment. Enterprises can also achieve their social responsibilities through the implementation and popularization of the SW as soon as possible.

INTRODUCTION
There is an excessive consumption which may lead to 7 trends of crises, including destruction of the social atmosphere, energy crisis, social decline and conflicts and so on [2]. Over consumption deteriorates human health. To reduce deteriorated health due to excessive consumption, smart watch has also become a hot topic; more and more and more people focus on healthy diet habits. In reality, people are easy to purchase things that they do not need because of their insufficient understanding of their needs. It leads to overconsumption and health deterioration. Research on how mobility and social connectivity combine to produce new knowledge, business practices, and social implications is likely to become the fourth era of m-commerce in the near future [4]. That is a good opportunity to do a survey on potential users of smart watches and devise a new one to satisfy possible needs. To have a understanding of the market’s demands of SW and its effects on our designed SW, it motivated this study. Besides, we want to study if we can be inspired from related IOT smart product and study the adherence of users to our SW.

LITERATURE REVIEW
Digitization, networking and information are the era characteristics of the 21st century. With the rapid increasing number of mobile users, e-commerce has been in worldwide popularity and development. It provides the world with a good environment of trades and greatly facilitate the communication, save the costs of managements as well as the enterprise costs. Under this background, it would be better for the companies to find some effective ways to meet the needs of market, e.g. E-commerce.

Some studies show that expectations of accuracy, security, network speed, user-friendliness, user involvement and convenience are the most critical quality attributes underlying perceived usefulness. Regression discovered that the willingness to use depended significantly on the first five factors, which allow inter-dependencies and marginal rates of substitution between them to be estimated. Our results concentrate on demand-side changes by explaining the recent slowdown of Internet e-retail banking, which may be useful for development of planning and marketing [5][6].

Nowadays, health problem has become more and more serious. Thus, how to keep fit is also a hot topic in the world. In 1987, John Robbins published a book named Diet for a New America, which was an early version of food revolution. After that, he continued to work tirelessly to promote conscious food choices for more than 20 years. A suggested diet by SW is always a vegetarian which is consistent with Robbins’s book, which can improve health and protect environment.

RESEARCH METHOD
Research Methods
The data of Table 2of Appendix are from the National Bureau of Statistics of the People's Republic of China. It is about the proportion of the total population of heart disease in the country. Over the past five years, the survey data from city has showed that heart disease has become the leading cause of death, especially in women. In research, users valued two things most: notification, especially in connection with high mobility; and support for simple activities like tracking [3]. It is expected that people like smart products with notification and tracking for health status, exercise and sleep.

Thus, it motivated us to innovate a new product SW, which can effectively prevent heart disease by the way of getting people's heart rate, heart rhythm, blood pressure, sleep time, and by analyzing them, people can know their physical condition at time.

Heart rate is the number of beats per minute of a normal person in a quiet state. It is also called quiet heart rate which is generally beats 60 to 100 times per minute. Studies have found that heart rate can reflect a lot of health information, including:

The Fifteenth International Conference on Electronic Business, Hong Kong, December 6-10, 2015

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**The length of life:** Life scientists have come to the conclusion that the secret of longevity is to keep the heart beats calm as much as possible.

**The risk of heart disease:** One pair of 34,000 surveys show that the mortality of people whose heart rates faster than normal 12 beats per minute is 27% higher than normal. This suggests that one cannot disregard the heart rate speed.

**Indicating the prognosis of heart disease:** The patient's heart rate is always higher than normal, and the gap between the fastest and slowest heart rate is small. What's more, they are more likely to die of heart attack within a year after being indicated by the prognosis of heart disease. This suggests that the treatment of stable and slow heart beats is directly related to the survival rate of patients.

**Guiding tips of exercise:** The amount of exercise was measured by heart rate.

**Implying the workload:** Whether a person's fatigue is caused by overwork or over exercise can be judged by the heart rate of the next morning.

The operation principle of the measurement of the heart rate of the SW is a sensor which can identify the differences between the skin and the skin contact. If the heart rate exceeds the normal range, it will alert the user to pay attention to the changes of the heart rate, and provide the reason why the heart rate is too high or too slow. Then users can introspect whether their own behaviors are good or not.

From this, the SW can analyze the data changes during a period of time and then we can know whether the user’s heart rhythm is normal.

Blood pressure is the pressure that can cause a person's blood being delivered to all parts of the body. Abnormal blood pressure can change the structures and functions of the heart, so as to cause heart disease. The disease with long-term high blood pressure can cause hypertensive heart disease. Therefore, in our daily life, we should also pay attention to our own blood pressure changes to prevent the disease caused by abnormal blood pressure.

SW can measure the blood pressure for users effectively during a long period of time by photoelectric sensing technology and it can also analyze users’ blood pressure over time. Once it is beyond the normal range of blood pressure values, SWs will automatically remind users to take care of himself. Through analysis of users of cardiac arrhythmias, heart rate, and blood pressure values, it provides users with the good suggestions of exercise time, motion, and cautions of diet users should know.

Adequate sleep, balanced diet and appropriate exercise are recognized as three health standards by the international community. And SW can detect the sleep qualities of humans, which can help indicate people’s physical condition. We all know that heart rate will be lower when people are asleep. The SW can measure the user's heart rate to customize the rest schedules of the users. Thereby it can not only help reduce the risk of heart disease, but also prevent users from suffering other diseases.

With the help of the IOT network, SW can collect and analyze the data of the users without revealing the user's privacy, and then by carrying out the tracking analysis, scientists can get useful information for their scientific research.

SW will not only focus on the watch body, but also the watch band, which will be designed to something just like the computer screen. In this way, SW watch will not become a fast fashion. What's more, it can meet the needs of people on different occasions, which, to some extent, can reduce the excessive consumption.

There are a lot of people who do not have routine physical examination because of certain objective or subjective reasons. The SW can help them better detect their physical condition, and prevent them from suffering diseases in time. So, this is a stylish and healthy product which can prevent heart disease and other diseases.

**Designed Features**

Solar charging: the conversion light, heat and electricity is to use energy from solar radiation and people's heat from their movements to generate a current.

Recording sleeping quality: The users’ sleep time and qualities can be detected by the watch. Sleep can be divided into shallow sleep and deep sleep. Deep sleep can relieve the fatigue of the body. It is the surveillance of human health that can not only improve users’ sleep qualities but also keep abreast of their physical conditions.
Intelligent alarm clock: such kind of humane design can wake you up from deep sleep gradually rather than wake you up roughly as the kind of ordinary alarm clock. The watch will wake you up within a period of time you set through the increasing intensity of vibrations gradually. You will be woken up in deep sleep gradually, and you will be more dynamic and energetic in the rest of the day.

Emergency phone: the special band can detect the users' heart rate and blood pressure, etc. Once these measurements reach the risk value, the watch will dial the emergency hotline automatically to reduce the occurrence of accidents of life. The watch is such a great invention that can reduce mortality effectively.

**Questionnaire**

Questionnaire is the most widely used method for data collection, which is feasible and effective.

It is economical and timesaving. In order to testify the hypothesis effectively, the study will base on the general principles and methods of empirical research, using questionnaires to testify the theoretical construction.

With the questionnaires finished by the masses who were investigated, we can get the latest information. The questionnaire contains many aspects, including the understanding of the app, the acceptable menu of the app, the necessity of giving advice on dietary habits, the reason why they like or do not like the app, as well as the changes of people's attitudes towards the Diet Manager.

**RESULTS**

**Data Collection**

The study used the questionnaire to collect data. And sampling is also conducted because of the limited time and energy, under the premise of the research’s objectiveness.

The research is to make an online survey to look into the development prospect of Diet Manager. And the people who were investigated are mostly among the young man in Guangdong province of China.

There is no limitation of time for participants so that they will not be nervous or strange, which can ensure the accuracy of the data.

**Sample Description**

A total of 454 questionnaires were distributed, and 454 questionnaires were gathered. The detailed content can be found in the following tables.

<table>
<thead>
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<th>Table 1. A formal investigation of the personal information of the sample</th>
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There are 213 males (46.92% of all) in the sample, and 241 females (53.08% of all). Most of the participants are aged from the age of 26 to 35, with a total of 287. The sample participants are mainly office workers.

The answers for questions are as follows: 98.9% of surveyed participants have ever used App; 65.42% of the participants will follow the suggested alarm to exercise; 64.32% of those will follow the suggested alarm to sleep according to individual sleep status; 76.9% of those think the reported status of individual health is helpful; 90.97% of those think it is necessary to eat following a recipe according to personal health status; 89.43% of those think to be a vegan can save a lot of healthcare resources; 82.6% of...
those think to be a vegan can transfer grain from livestock to hungers to save more people. 90.84% of those think to be a vegan can transfer grain from livestock to others and reduce costs due to transportation of the livestock. It reveals that people care health and less energy consumption due to transportation, and thus can guide people to reduce over consumption with green logistics benefit. It is also interesting that people care exercise more than sleep toward a good health.

CONCLUSION

With the rapid development of e-commerce, APP is a hot topic around the world. It covers almost every aspect of human life, such as clothing, exercising, foods and so on. So an app based on users’ individual physical condition may be feasible. This article is mainly to discuss the development prospect of Diet Manager. The following is the conclusion of the paper.

Firstly, there is a good potential growth for the diet users with available smart phone users. Secondly, there is few available app about diet. Furthermore, most people have no access to similar app before while there is a strong need for recipes. There are about 69% of all the participants have a need of customized recipes in accordance with their own physical conditions, and about 70% of all the participants think that the special customized app are necessary.

Social Implications

Economy, environment and community are three respects for an enterprise’s social responsibility. Since the popularization of SW, less food and energy can be achieved with accompanying less environmental destruction, improved community welfare, and the enterprise’s social image. Enterprises can also achieve their social responsibility through the implementation and popularization of the SW.

Limitations of this Paper

This article adopted statistical approach to analyze several aspects of all possibilities of SW. Meanwhile, object is mainly to one than other professional or age groups without more layers and data. People who do not have their own kitchens may be unlikely to adapt SW’s suggestions and cook for themselves. Thus, alternative survey done by people of different industries can help reduce the participants’ selection bias. Furthermore, poor medical adherence caused by poor memory or mental disorder is not included in this study. Self-efficacy for acceptance, diffusion theory, attitude towards smart phone adoption affected by testability and organizational and environmental factors are remained as future works[1].

We hope this innovative human technology can be implemented and popularized as soon as possible so that the unnecessary consumption can be reduced. In this way, it can provide a good atmosphere for human health, over consumption, healthcare and transportation.

REFERENCES

Appendix
Table 2.

The number of the Chinese died from heart disease which accounts for the total quantity of dead people

The number of Chinese died from heart disease over the total quantity of dead people

The number of Chinese men died from heart disease over the total quantity of dead people

The number of Chinese women died from heart disease over the total quantity of dead people
A PROPOSED MODEL OF BUSINESS CO-CREATION FOR SERVICE INNOVATION

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ABSTRACT

This study explores the dynamics of collaboration between travel agents and their suppliers in co-creating value for their customers. It examines the relationship among co-creation elements, service innovation, technology adoption and environmental change. Results indicate that all the above effects are significant.

Keywords: Business co-creation, service innovation, service dominant logic.

INTRODUCTION

Continued growth in the global tourism industry has opened vast opportunities to many businesses in the tourism and hospitality industries. International tourist arrivals reached 1.138 million in 2014, a 4.7% increase over the previous year and a forecast growth by 3% to 4% in 2015 (World Tourism Organization, 2015). Travel & Tourism’s total contribution to the global economy has risen to 9.5% of global GDP (US $7 trillion). Travel & Tourism forecasts over the next ten years also look extremely favorable. But capitalizing on the growth opportunity will require authorities to create a favorable climate for infrastructure investment and people development (World Travel & Tourism Council, 2015). Growth can be attributed to advances in web and information technology (IT) that have changed the service landscape to favor consumers through e-marketing and social networking. As businesses in the tourism and hospitality industries jockey for position to lure potential customers, several will join forces to interact with them to better learn of and understand their needs, which in turn provides the businesses a basis for customizing offerings and co-creating value.

Value co-creation involves the customer deriving value through his/her use of a product or service offering, and his/her involvement in the co-design and co-production of the offering. Extending the idea, business co-creation not only emphasize on the collaboration with consumers but also the collaboration with partners (suppliers) to design new services and enhance customer values. The value is no longer defined by the producer or provider only, but by the level of satisfaction a customer attains as a result of using the offering. With the adoption of value co-creation, the dominant marketing logic has clearly shifted to service-dominant (S-D) logic, which emphasizes the integration of goods with services and has become a vehicle that enables customers to pursue their individual satisfaction through the accomplishment of a task or gains in efficacy.

Co-creation refers to collaboration between the supplier and the buyer (the customer) in the process of value creation that the buyer or the customer plays an active role as an innovator in the innovation process. The customers share their consumption experience and the company valued this experience as an opportunity to enhance its products or services with tailored to their preferences. The dynamic nature of market conditions and the ever-changing customer needs require ongoing interactions between the business and its customers for co-creation. Comparing to co-production or customer involvement, co-creation is more emphasis on the mission driven process to create values with customers. Moreover, co-creation dynamics is defined as a process of value creation between a business and its suppliers through collaborative elements and a continuous social and economic process that begins with an interactive definition of the customer’s problems or potential needs. Prahalad and Ramaswamy identified four fundamental collaborative elements for co-creation: dialogue (e.g. interactivity, engagement, propensity to act), access (e.g. sharing of information and knowledge), risk assessment (e.g. providing information to make informed decisions), and transparency (e.g. openness) - that is the DART model. These elements are crucial to the interaction process between the business and its suppliers. By coupling them in different combinations (e.g., dialog and access, risk assessment and transparency, etc.), a business can apply them towards developing different strategies with its suppliers. For example, transparency facilitates effective dialogues and provides streamline access so that customers are easier to collaborate with the customers.

Moreover, in a B2B setting, compatibility and flexibility reflect the fits of the relationship between business partners (e.g., buyer and supplier) that are conducive to collaboration. Flexibility defines the responsiveness of a business to adapt changes in technology and market opportunities by introducing new offerings, broadening its product line, and upgrading its offerings with greater timeliness. Flexible organization can provide more capabilities of quick adjustment in new product and process design, more possibilities of employee authorization and empowerment. Furthermore, compatibility describes the extent of match between (among) partners in culture orientations, abilities, and activities of the businesses play toward their successful integration. In an inter-organizational context, the degree of compatibility can predict the success or failure of joint ventures that high compatible partners would yield better collaborating outcomes. The greater compatibility between partners segues to higher co-creation capability.

This study intends to interpret business co-creation and discuss whether and how business co-creation has effects on service innovation in tourism industry. This study explores the dynamics of collaboration between travel agents and their suppliers in co-creating value for their customers. It examines the relationship among co-creation elements, service innovation, technology
adoption and environmental change, and the moderating effects of trust. Results indicate that all the above effects are significant.
A REFERRAL REWARDS INCENTIVE DESIGN ON TRAVEL CONSUMER-GENERATED CONTENT

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ABSTRACT

User-generated content has become increasingly important to both tourism practitioners and travel consumers. Although prior studies have demonstrated how impactful UGC is and why marketing mavens employ UGC sites in their marketing campaigns, there is still scant evidence on how to successfully manipulate them. To fill this void, we conducted a two-phase experiment study. In the experiment, first, 65 tourists were invited then grouped according to three different treatments (namely, creating travel posts to achieve the maximum ‘comments’, ‘retweets’, or ‘likes’), and one will be rewarded if he/she achieves the goal. Second, for the manipulation check, we invited another group of Chinese consumers (n = 268) to rate these travel posts based on their perceptions. Our experiment results indicate that this referral rewards incentive design has significant effects on consumers’ UGC perception (the credibility, interestingness, influence of postings), behavioral intentions (purchase intention, and WOM intention), and their likelihood of social media engagement (offering ‘likes’). In addition, we also discuss the implications of the results and how to exploit this design.

Keywords: Referral rewards incentive design, travel consumers, user-generated-content (UGC), social media engagement, behavioral intentions, and attitude toward destination.

INTRODUCTION

Social media are considered as one of the two ‘mega trends’ (together with ‘search engines’) that have revolutionized travel consumers on how they transfer, share, reuse, store, and generate travel-related knowledge [54, 68]. This revolution transforms what was like in the old days, when experiences were only shared and diffused within small circles of acquaintances with mutual trust, into global customers’ information database that can be analyzed by both researchers and practitioners [34]. Marketing mavens started to realize that it is no longer enough for their tourism businesses to rely solely on traditional media for competitions but must refer to social media as their marketing tool to comprehend what their customers’ demand [36].

Given the emergence and prevalence of social media among businesses, a plethora of research has been conducted on the applications of social media from the tourism suppliers’ perspective. For instance, first, social media can be used as a strategic tool to enhance the image of destination. Researchers point out that travel-related UGC sites reflect more genuine attitudes and opinions of travel consumers, and destination management organizations can exploit this information to identify unsuspected features and make cost-effective approach to understand travelers’ experiences [2] [37]. Second, social media are regarded as inexpensive ways of promotion compared to traditional advertising [37]. Studies suggested that blogging/twittering is more effective in improving search engine rankings, increasing traffic to company websites, promoting products and offerings, responding consumer inquiries, which all result in the increase of online sales of destinations [42] [55]. Third, instead of direct distribution to travel consumers, suppliers can take advantages of social media to enhance their indirect distribution of travel products/services. Due to this, their distribution cost could be decrease and more revenue would be generated [37] [59]. Fourth, social media can provide tourism marketers with instant communication vehicles to transmit brand values, services updates and other relevant information to the mind of their consumers[55]. Last but not least, UGC is treated as sustainable source that can be applied into business strategies development, such as improving potential customers’ satisfaction; solving problems that consumers confront; exploring customers’ travel experiences; and monitoring the image and reputation of a business [37].

Despite a wide use of social media by tourism practitioners in the past few years, the successful practice of manipulating and managing social media remains largely unknown to both researchers and practitioners [12] [13] [37]. Social media, to a large extent, rely on voluntary resources contributed by individual peers. However, studies [3] [25] pointed out that having time and work constrains, no interests, lack of confidence in writing, being lazy, privacy issues, and shyness over public postings are prominent reasons for not contributing. Therefore, how to encourage cooperative behavior among peers avoiding free-riders (consumers who lack of cooperation) and how to develop mechanism, by which contributions of individuals can be incentivized, have become critical issues to modern tourism practitioners [14][28].

In the system of autonomous but rational participants, scholars found resource contributors can be incentivized by using economic principles, such as monetary payments (one is paid to contribute resources), and different services (resource contributors can have better quality of service if they contribute more), and etc.[28]. However, very little research has been conducted in the context of tourism in social media. In our research, we propose a referral rewards incentive mechanism. With the intention to find out how impactful this incentive design is, we conducted a two-phase experiment study. In the first phase, for incentivizing tourists , we
created a mechanism with three treatments (namely, creating travel posts to achieve the maximum ‘comments’, ‘retweets’, or ‘likes’). Then the tourists we invited were divided into three groups according to these treatments. Each of them is told that he/she would have a chance to be rewarded (a bottle of red wine/a sum of phone bill charge that is equivalent to the value of wine) on the condition that his/her travelling post would obtain potential travel customers’ the maximum ‘likes/comments/retweets’. In the second phase, another group of travel consumers were invited to rate these travel posts based on their perceptions. By employing one-way ANOVA, we observed the effects of such an incentive design on customers’ perceptions (the consumer-generated content’s credibility, influence, and interestingness); the impacts variations across the potential travel customers’ behavioral intentions (purchase intention, word-of-mouth intention) and attitude towards destinations; and also consumers likelihood of engagement (retweet, comment, like). Our research attempts to provide an solution to how to design a successful viral tourism marketing campaign and a better way to avoid the spread of consumer backlash.

This paper first reviews the current study on referral rewards incentive design in general, and travel customers’ UGC perception, social media engagement, behavioral intentions, and attitudes of destination. It then illustrates how our study is conducted. After that, the paper presents the results. Finally, the paper concludes with touches on the practical implications.

**REFERRAL REWARDS, TRAVEL CONSUMERS’ UGC PERCEPTION, SOCIAL MEDIA ENGAGEMENT, BEHAVIORAL INTENTIONS, AND ATTITUDES TOWARD DESTINATION**

**Referral Rewards**

It is no longer a novelty that companies offer referral rewards to motivate existing consumers to spread positive word-of-mouth (WOM) with the intention to acquire new consumers. Such incentives have been considered as one of the manipulation strategies that companies are increasingly sophisticated about by the day. Research even points out that when the referral incentive system’ effectiveness is sufficiently high, it will overturned the direct marketing [20].

Word-of-mouth can be deemed as a sort of exchange. According to exchange theories, resources that people possess can be managed. This includes both tangible products, which hold economic or symbolic value, and intangible products, such as information [5]. Marketing research found that consumers’ respond to referral rewards on whether they will engage in WOM transmission is depending on the cost and benefits of exchange [32] [52]. According to Ryu and Feick’s study, referral rewards will make exchange more complex in WOM. In contrast with natural WOM, WOM under the referral rewards programs has added exchange on how consumer perceives a referral’s cost and benefits. During the process, recommender gains additional economic benefits (e.g. money). However, his/her social risk has increased, because if receiver of the rewarded referral is discontent with the recommended product/service, the receiver might impute this discontent to the recommender. On the other hand, from the recommenders’ perspective, their motivation for making the referral is incentivized by the rewards rather than instinct. They may feel that they did sell their ‘recommendations’, which is inconsistent with their self-image [52].

In a dynamic setting, modern scholars have already wielded enormous clout in referral rewards programs (see Table 1). Focusing on the adoption of referral rewards programs, these findings have insight views. For instance, those referred customers were found to have a higher contribution margin, retention rate, and they are more valuable in both short and long run [56]. In addition, a certain reward could increase customers’ referral likelihood. However, the referral rewards are considered more effective on the providers of the recommendation for weak ties and weak brand; whereas for strong ties and strong brands, rewards should be offered to receivers of the referral to take effects [52]. Moreover, the satisfied customers were deemed as a necessary but not sufficient condition for a company to acquire positive word-of-mouth. Nevertheless, referral rewards can be an effective mechanism to increase satisfied customers’ likelihood of making referrals [74]. What is more interesting, compared to in-kind rewards, monetary rewards are less powerful in motivating customers’ referral behavior. This due to the fact that despite money is desired by everyone, offering money as rewards in referral program has potential flip side. Customers might decline to participate in the program, because their social cost (such as, acquisition of social obligations, the risk of providing inappropriate advice, and etc.) associated with monetary rewards cannot be balanced with their economic benefits [35].

On the other hand, with the attempts to encourage more consumers to purchase the companies’ services and establish consumer loyalty, contemporary practitioners take advantage of social media to reward their customers who would like to start favorable conversations about their products, and they also persuade influential social media participants to write impressive reviews that will draw other peer customers’ attention. Indeed, social media create platforms that allow close friends, distant acquaintances, or even strangers to communicate conveniently. Such kind of communicating style makes online social referrals come true among social media participants with different social distance, and companies can exploit this referral systems by establishing a consumer recommendation system (CRM) to manage social interactions [25]. In Shao and Zhang’s study, by investigating 180 ordinary Chinese consumers, social media were found to have great influence on consumer referrals, and they are more efficient and effective for enterprises to acquire customers compared with the traditional marketing campaigns [58]. However, although utilizing tangible referral rewards can incentivize existing consumers to introduce new consumers to business at a low acquisition cost, rewards can sometimes be distributed to consumers who would have recommended the product anyway, and this results in a waste.
of resources [27].

<table>
<thead>
<tr>
<th>Research</th>
<th>Methodology</th>
<th>Key Findings</th>
</tr>
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<tbody>
<tr>
<td>Biyalogorsky et.al (2001) [10]</td>
<td>Analytical modeling</td>
<td>Underlines the advantage of using referral rewards besides the adoption of lowering the price while motivating customers’ referral behavior; providing guidelines to marketing mavens on how to optimize the price and rewards.</td>
</tr>
<tr>
<td>Ryu and Feick (2007) [52]</td>
<td>4 laboratory Experiments</td>
<td>Rewards increase customers’ likelihood of referrals; rewards are more effective in weak ties and weak brands.</td>
</tr>
<tr>
<td>Wirtz et.al (2012) [74]</td>
<td>An in-depth interview and 2 field experiments</td>
<td>Extending the understanding of ‘meta-perception as significant factor in interpreting the referral behavior; the level of satisfaction with the referral rewards increases the WOM givers’ likelihood of recommend.</td>
</tr>
<tr>
<td>Garnefeld et.al (2013) [23]</td>
<td>Filed experiment</td>
<td>Referral rewards increase the existing customers’ loyalty; larger rewards reinforce attitudinal and behavioral loyalty, but smaller rewards impact only the behavioral dimension.</td>
</tr>
<tr>
<td>Jin and Huang (2014) [35]</td>
<td>3 laboratory experiments and 1 field study</td>
<td>Compared to in-kind rewards, monetary rewards yields less referral generation and acceptance, particularly in the case of weak brands.</td>
</tr>
<tr>
<td>Li &amp; Liu (2015) [33]</td>
<td>2x4 scenario experiments</td>
<td>Rewards dose not significantly yield electronic referral (WOM); and participants’ closeness is found to be a key variable in explaining online referral behavior.</td>
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Customers’ UGC Perception

The influence of user-generated content on travel customers

Known as the ‘electronic word-of-mouth’ (eWOM), user-generated content facilitate customers with commercial, detailed, and experiential information. As a result, ideas and opinions are more easily accessible, and customers who collect the information are often better informed [1] [38]. This fact becomes especially persuasive in the context of tourism industry.

Compared to the other products, tourism products are high-priced, high-involvement, and well differentiated in nature, which make their quality cannot be evaluated before they are actually consumed. Hence, travel UGC about destinations, hotels, transportation, and services turns to be significantly important source for travel consumers. And the impact of UGC on travel consumers can be understood from the different phrases of consumers’ travel, such as, pre-trip, during trip, and post-trip [37].

In the pre-trip, UGC acts as an additional source of information to consumers [75]. Consumers often utilize UGC in early stage of their travel to minimize the perceived risk of making wrong decisions [26] [47] [55]; and they usually consider UGC from experienced travelers to be more up-to-the-minute, credible, and enjoyable than information provided by travel service providers [26]. However, some findings also indicated that the relatively greater trust is placed in a specific travel UGC site rather than a generic one [15]. During trip, studies have proven that UGC can strongly influence consumers’ purchasing decisions, and consumer perception of quality. For instance, the consumers’ likelihood of booking hotels is determined by the ratings of travel UGC in addition to valence and framing [37] [65]. Besides, UGC facilitates the travel consumers to obtain destination information, which subsequently stimulate a higher motivation of choosing the destination [69]. Moreover, UGC enables the consumers to visualize the consumption of the travel products [69]. In the post-trip, when consumers complete a trip, they turn into UGC generators. Research has found the reasons motivate their contribution are associated with travel consumers’ personality (such as, altruistic and enjoyment), and their desire to share life experience and make social interactions [47] [77].

Credibility of UGC

Credibility is defined as ‘believability of some information and its source’[6]. In the information process, credibility can change a recipient’s opinion in accordance with the direction advocated by the communicator when the content is built on highly credible source [31], and less credible information cannot draw customers’ attention[43]. Study also indicated that those consumers who perceive a review to be credible are more confident of adopting social transmission and making purchase decisions [66].

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UGC is considered as more credible than official destination websites, travel agents, and mass media [21]. This, subsequently yields more impacts on tourists’ destination choices [18]. Meanwhile, it acts as a role of reducing travel consumers’ perceived risks when booking travel products [65]. Due to the intangible nature of travel products, the economic and psychological risks are always embedded in the travel decision making. Therefore, the credibility of UGC is more important to consumers. Research has already pointed out that the degree of the credibility allotted by the travel consumers to the content of UGC is associated with how impactful the UGC is to their travel plans[6]. However, in contrast with face-to-face communication, consumers involved in eWOM (UGC) cannot adopt paraverbal cues to cognize the credibility of communication source. Besides, travel UGC is often written by anonymous tourists who have no prior relationship with the viewers. This makes evaluating the credibility of UGC is even more difficult.

**Interestingness of UGC**

Electronic word-of-mouth (eWOM) has become increasingly important to consumers’ everyday life. They post reviews on movies they hate, share experiences of the products they used online. All these types of conversations that appear in social media are mostly discontinuous in nature. This means, after a person writes a post or comment, he/she usually does not expect an immediate response (even there is ‘immediate’, is regarded as one that occurs minutes later). As these types of conversations are asynchronous, people have sufficient time to think of a clever or interesting response, or wait till they have something worthwhile to share. For instance, a novelist is more adept at text than in person, due to he/she has more time to craft a more perfect response. Inferentially, in discontinuous communication, people are more likely to share something they consider interesting [9]. In the prior work of Berger and Milkman (2012), those more frequently shared articles of New York Times were found more interesting than others. In addition, they also pointed out that key to generate influential word-of-mouth is to be interesting, as nobody would like to discuss boring business, boring products, or boring advertisements [63]. Moreover, from the content perspective, Hidi and Baird regarded ‘interestingness’ as one of the most significant variables that impact the readers’ evaluative judgements. They indicated that the interesting content would be easily accepted, while the dull one would lose readers before any message is delivered [30].

Based on the prior study [78], influential UGC needs to have features such as interestingness and credibility. Hence, we assume that, with the intention to obtain rewards, creators will make endeavors to approach this criteria to generate more influence, interesting, and credible posts.

**H.1. Referral rewards incentive design will positively impact travel consumers' UGC perception, namely, credibility, influence and interestingness of posts.**

**Travel Consumers’ Behavior Intentions**

**Purchase intention**

Both the perceived popularity and informativeness of the UGC information can influence consumers’ purchase intention, and subsequently, consumers may choose a product that had not been in their original consideration set [22] [48]. This phenomenon can be explained by two factors: first, consumers have the social desirability to meet the expectations of others. Therefore, after observations, they often conform to the behaviors of others [79]. Besides spouse, relatives, friends, consumers are also vacillated by the popular opinions that provides easy rationales and justifications [51]. Second, UGC can reduce the cognitive load of a viewer, and consequently yields higher sales [24]. Results [7] of a survey done by Channel Advisor indicated that, of all the consumers they investigated, around 92% read the product reviews online before they made decisions; and 83% of the holiday shoppers were influenced by travel UGC from different aspects. In addition, recommendation from friends and positive and negative UGC from strangers are regarded as the most significant factors that impact travel consumers’ online hotel booking; and the UGC of hotels improves the average probability for consumers to consider booking the hotel rooms [21] [70].

**Word-of-mouth intention**

Researchers [41] define word-of-mouth as ‘an oral, person-to-person communication between a receiver and a communicator whom the receiver perceives as non-commercial, regarding a brand, product service’. As this kind of communication appears spontaneously, it usually vanishes soon after it is spoken [17]. Nevertheless, WOM has been deemed as vitally important to travel consumers since decades ago. In the typologies of tourists categorize by Cohen, the ‘theory of allocentricity and psychocentricty proposed by Plog, and the ‘tourists area life-cycle mode’ design by Bulter, the innovative and adventurous tourists were considered as both ‘pioneers’ and ‘opinion leaders’, for they not only discovered new destinations but also shared their experience with others [16] [19] [38] [49]. WOM is known as eWOM in digital age. It is a positive or negative statement that can be made by any potential, actual, or prior customers concerning a product or a company; it is available to the broad masses of the people and institution online [29]. However, in contrast with WOM, eWOM needs not to be direct or oral, as consumers generate all the content online and it will not be ephemeral, and consequently consumers can consult the content even after a long period. Besides, although it is different from advertising with regarding to information source, sometimes it comes with intervention from companies, who purposefully encourage customers to accelerate WOM transmission [17] [41]. Recent research in tourism area has demonstrated different impacts that WOM has upon different tourism products. For instance, research [44] conducted in New
Zealand found, while the dissatisfied consumers spread unflattering comment concerning their travel experiences online, that WOM will dreadfully influence the destination image; and WOM recommendation increase the wine sale in Australia when opinion leaders returned home having others know their taste experience [40]; also study [57] in Western Australia noted that most local people’s travel decisions were made based upon WOM communication. In UGC sites, travel consumers were found appreciate social benefits, which implies that they are willing to discuss their ideas and provide assistance to others (WOM intention) [73].

**Travel consumers’ attitude toward destination brands**

Travel consumers’ attitude can be defined as the psychological tendencies delivered by the positive and negative evaluations of consumers when engaged in certain travel behavior [50]. It includes cognitive response (evaluation during the formation of an attitude), affective response (psychological response indicates the preference of consumers towards an entity), and behavioral component (a verbal indication of the intention that consumer will involve in the travel products) [71]. In addition, the intention behind an attitude can impact the external behaviors. The more favorable the attitude toward the behavior, the more likely the individual will perform the behavior[11] [50] . On the other hand, nowadays, the reputation of tourism destination brand is notably influenced by the aggregation of UGC. Most travel consumers use formal elements of destination such as taglines, slogans, logos in all kinds of their postings, which will affect other peer consumers’ attitude toward the destination as a result [4] [72]. The attitude of consumer, according to the prior findings, is a significant predictor of decision for travel a certain destination [64].

Discussed as earlier, studies already indicated that, with the assistance of referral rewards programs, there is significant change in receivers’ purchase intention, and WOM intention. Accordingly, their attitude toward destination will be affected as well.

**H.2. Referral rewards incentive design will positively impact travel consumers' behavioral intentions (purchase intention, WOM intention) and attitude toward destination.**

**Travel Consumers’ Social Media Engagement**

In order to define social media engagement, recent studies have set out to understand the concepts of ‘engagement’. First, engagement is utilitarian. It is on the basis of social facilitation, civic mindedness, and inspiration [46]. Second, engagement is experiential. It is a progression that begins with interacting with the interface physically, and eventually becomes cognitively addicted to the content provided by it, and then disseminates the outcomes of the involvement proactively [45]. Third, the concept of engagement includes cognitive, attitudinal, and behavioral attachment; and those engaged individuals present ‘feelings of persistence, vigor, energy, dedication, absorption, and enthusiasm’ [39] [61] [76]. Hence, social media engagement can be understood as the state of cognitive and emotional combination while employing social media tools[61]. In communication research, social media is examined as ‘a form of one-way communication’, whereby individuals and organizations send out messages with the attempts to secure ‘engagement’ as views, likes, comments and shares (retweets) [61] [67]. Moreover, social media engagement is often associated with online support and proactive interaction [8].

In social media, under the referral rewards incentive design, because each of the recommender wants to gain rewards, they will put more efforts to generate posts to draw peer consumers’ attentions accomplishing the tasks. Consequently, these peer consumers are likely to comment, retweet, and/or offer 'likes' to these posts.

**H.3. Referral rewards incentive design will positively impact travel consumers' social media engagement, namely, likelihood of retweet, comment, and like.**

**METHOD**

With the attempts to check the effects of the referral rewards incentive design on consumers’ UGC perception, behavioral intentions, attitudes toward destination, and social media engagement, a two-phase experiment was conducted among Chinese consumers. The procedure contains incentivizing one group of travel consumers to generate travel posts, and inviting another group of consumers to rate these posts according to their perceptions.

**Procedures and manipulation**

- **In Phase 1**, we recruited 40 MBA students from Fudan University in China and another 40 Chinese adult consumers who may not hold the same degree or equivalent but are keen on posting on UGC sites. To incentivize these participants, we created a scenario that ‘a certain tourism company intends to market the destination (the place impresses you the most) on social media.’ You are kindly invited to create a travel post, which depicts the most impressive experience and feeling toward a travel that you had during the last 12 months. The post will be published on one of the Chinese social media applications (e.g. Microblogs, WeChat, travel communities/blogs, etc. later, and your goal is to obtain the most ‘comments’ (or ‘likes’, or ‘retweets’, randomly assigned) from peer viewers. Once succeed in accomplishing the task, you will be rewarded a bottle of Chateau Fleur Cardinale/ a sum of phone bill charge that is equivalent to the value of wine, which is worth approximately 30 euros.’

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Then, under the help of ‘Qualtrics’ (www.qualtrics.com; an industry-provider of Online Survey Software and Insight Platform), the participants were randomly divided into three groups (treatments): 1. participants intend to achieve the maximum ‘comments’; 2. participants intend to achieve the maximum ‘likes’; 3. participants intend to achieve the maximum ‘retweets’.

To guide these participants, we asked a couple of items (see Table 2) which concerning their most impressive travel experience during the last 12 months.

In Phase 2, another 300 Chinese consumers were invited to rate these travel posts created in Phase 1 based on their perceptions. Each of these consumers will confront 6 different posts (randomly assigned by ‘Qualtrics’), which are actually real travel postings with regard to some travel consumers’ very recent travel experience.

Regarding the unit of analysis we conducted, data in our study follows a nested structure. Rating of each post are nested in travel posts, same as students are nested in certain class. In Phase 1, each of the participants received one of the three experiment treatments and created travel posts accordingly. In Phase 2, each invited consumer rated 6 different posts randomly assigned to them. Consequently, posts created under each of the three experiment treatments in Phase 1 have equal probability to be exposed to each consumer in Phase 2. Similarly, probability for a consumer to read posts under three treatments is equal as well. Therefore, the 6 posts are drawn from all three groups in Phase 1 even though not necessarily always 2 posts from each group. Hence, the sets of the 6 posts vary across the 300 participants in Phase 2.

Table 2. Items applied in Phase 1. [78]

<table>
<thead>
<tr>
<th>Guiding items for incentivizing the creation of travelling posts</th>
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<tbody>
<tr>
<td>• Among all the places you traveled during the last 12 months, which one impresses you the most?</td>
</tr>
<tr>
<td>• How long did you stay there?</td>
</tr>
<tr>
<td>• Were you happy with the stay? (scale 0 = not happy at all, 100 = extremely happy)</td>
</tr>
<tr>
<td>• Do you think this place is good value for money? (scale 0 = not good value for money at all, 100 = extremely good for money)</td>
</tr>
<tr>
<td>• In general, are you satisfied with the travel? (scale 0 = not satisfied at all, 100 = extremely satisfied)</td>
</tr>
<tr>
<td>• Compared with all the places you had traveled to, how good this place is; what’s ranking of it? (much smaller number means the ranking is higher; lager numbers means the ranking is lower)</td>
</tr>
<tr>
<td>• Assuming a friend of yours is planning a travel, how much would you like to recommend this place to him/her? (scale 0 = not at all, 100 = very much)</td>
</tr>
<tr>
<td>• In terms of travel, do you consider yourself as a green hand or an expert? (scale 0 = totally a green hand, 100 = totally an expert).</td>
</tr>
<tr>
<td>• Assuming the tourism department in charge is about to marketing the place (Item 1) by facilitating social media. You are kindly invited to join the other tourists to generate a content depicting your experiences and feelings about the place. The content will later be published on one of the social media applications (e.g. Mircoblogs, WeChat, travel communities/blogs, etc.), and your aim is to make your postings have more ‘comments’ (or ‘likes’, or ‘retweets’, randomized by the system). Once your post achieve the maximum of ‘comments’ (or ‘likes’, or ‘retweets’), you will be rewarded with a bottle of wine (2011 Chateau Fleur Cardinale, values approx. 30€).</td>
</tr>
</tbody>
</table>

RESULTS

Out of all 80 participants in Phase 1, we received 65 valid travel posts. Among these postings, 22 were created with the attempts to achieve the maximum ‘comments’; 24 were for achieving the maximum ‘likes’; while the rest were created for achieving the maximum ‘retweets’. According to the observation of the description of these travel posts, we found these participants’ travel activities can be categorized into one of the headings such as recreation, holiday, healthy, study, religion, business, family, mission or meeting. Furthermore, these travel consumers either pursued spiritual renewal, educational improvement, or scientific or imperialistic exploration of unknown destinations. Thereupon, they are literally real tourists [53].

In addition, most of these tourists considered their travel is the best value for money (M = 85.82); most of them showed high degree of happiness (M = 87.09) and satisfaction (M = 87.60) towards the travel; and most of them would recommend the destinations to their friends (M = 80.32). In Phase 2, out of 300 Chinese consumers we invited, 278 of them rated the posts according to their perceptions. Thus, we got 1668 sets of ratings concerns the very 65 travel postings.
To examine the impacts of referral incentive design on travel consumers’ UGC perception, social media engagement, and behavioral intentions, attitude toward destinations, and compare the effects of 3 different treatments, our study employed one-way ANOVA in the analysis work.

First, after testing H.1., we found referral rewards incentive design has significant effects on travel consumers’ UGC perception, namely, the credibility of posts ($F (1665, 2) = 3.627, p = 0.027$); the influence of posts ($F (1665, 2) = 4.098, p = 0.017$) and the interestingness of posts ($F (1665, 2) = 4.727, p = 0.009$). Further, under three treatments, we found postings with the attempts to achieve the maximum ‘likes’ yields higher mean value of credibility ($M = 61.45$), interestingness ($M = 48.91$), and influences ($M = 47.50$) than the other two groups. Taken together, these results indicate that referral rewards do positively impact travel consumers’ UGC perceptions.

Second, regarding H.2., results indicate that referral rewards incentive design has significant impacts on travel consumers’ purchase intention ($F (1665, 2) = 3.117, p = 0.045$) and WOM intention ($F (1665, 2) = 4.176, p = 0.016$). However, rewards appeared to have no effect on consumers’ attitudes toward destination ($p > 0.05$). Still, under three treatments, those generated travel postings with the attempts to achieve the maximum ‘likes’ generate a higher mean value of purchase intention ($M = 50.70$) and WOM intention ($M = 49.75$) than the rest of the groups.

Third, after testing H.3., although we found incentive design takes a significant effect on the consumers’ likelihood of offering ‘likes’ ($F (1665, 2) = 3.730, p = 0.024$), the impacts on consumers’ likelihood of offering comments and retweeting the posts were not significant ($p > 0.05$). In addition, under the treatments, postings with the attempts to achieve the maximum ‘likes’ yield more mean value ($M = 45.56$) of consumers’ likelihood of offering ‘likes’ than the other groups.

**DISCUSSION AND IMPLICATION**

Our study sheds light on how to successfully manipulate social media by using referral rewards. First, UGC created under this incentive design takes effect on peers’ UGC perception. Especially, under the three treatments, peer consumers found those postings created with the intention to achieve the maximum of ‘likes’ were more impactful, credible and interesting. Therefore, for marketing managers who intend to exploit the design, in addition to pay heed to who should be rewarded while planning to incentivize recommenders (travel posting creators), they can also adjust rewards size with different purposes to balance the social cost and economic cost of the participants. On the other hand, practitioners can also extract those postings with more credibility, interestingness, and influence to explore what elements are embedded in the content, and this will enrich their marketing strategies. Second, results indicate that postings under this referral incentive design only impacted peer consumers’ likelihood of ‘likes’. This can be explained by the facts that, compared to comment and retweet the postings, offering ‘likes’ takes less efforts, and consumers might not suffer social risks (such as spread and/or discuss the information that dissatisfy their followers in social media, and etc.). Third, findings also imply that postings under incentive design impact consumers’ purchase intention and WOM intention, this means after viewing these travel posts, peer consumers will consider travelling to the destination and tell other people about it. In addition, referral rewards will yield more value of consumers’ purchase and WOM. However, it fails in influencing consumers on their attitude toward destinations. Marketing maven can look into these destination brands (week or strong) [10], and classify them to see if the effects of referral rewards will change.

Theoretically, our work broadens the exchange theory from concentrating on exchange between two parties to the examination of one to many, which is more complicated. In general, transmitting WOM has benefits which includes, reducing the post-purchase anxiety or dissonance; making a better impressions for others; and aiding others to make better decisions. However, it also comes with costs such as efforts and time for communicating [55]. By compensating these eWOM senders with rewards, we found this design ease the cost and lead to receivers’ (potential travel consumers) purchase and WOM intentions. This, on the other hand, indicates the utility of applying exchange theory to understanding eWOM.

However, as discussed earlier, this design will make consumers driven by rewards instead of their instinct. It is double-edged sword which may also stab the tourism market. There are already reported stories [62] indicated that some hotel managers intended to acquire profit in times of trouble. They disguised as consumers, or persuaded their employees to write fake glowing reviews about their products, or even composed negative reviews about their competitors. Hence, we sincerely suggest that practitioners should consider about the side-effects of referral reward before applying it.

**REFERENCE**


December 6

The moderating role of familiarity, presented at the 2015 12th International Conference on Service Systems and Service Management (ICSSSM), pp. 1–5.


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Yu & Zou

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A REVIEW OF DATA MONETIZATION: STRATEGIC USE OF BIG DATA
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ABSTRACT
In this data-rich big data age, industries are capable to collect data that could not be imagined before. Many industries today are now thinking of how to better use these data assets properly to generate value, either for internal or external purpose. Data monetization is adopted as one of strategies used to create additional stream of revenue from the discovery, capture, storage, analysis, dissemination, and use of that data. It gains in popularity among different industries. The three research questions of interest to this study are: (1) what does data monetization mean to business; (2) what are types of data monetization and industries currently use; (3) how to initiate a data monetization strategy. To address these questions, this study did a comprehensive review of prior research from academia as well as from industry. This study clarifies and defines the data monetization, presents the synthesis of use cases learned from other industries as well as provides guiding principles of how to start with data monetization. The contributions of this study are twofold. First, this paper contributes to industry communities that start to explore opportunities of creating value from their data assets but lack of directions and how to. Second, this study contributes to raise awareness of academic communities over the potential of big data monetization research and the opportunities in further discussing the converging information system and strategy domain.

Keywords: Big Data, Data Monetization, Strategic Use of Data, Big Data Application

INTRODUCTION
In this data-rich big data age, industries are capable to collect data that could not be imagined before. Many industries today are now thinking of how to better use these data assets properly to generate value, either internally or externally. Data monetization is adopted as one of strategies used to create additional stream of revenue from the discovery, capture, storage, analysis, dissemination, and use of that data. It gains in popularity among different industries looking out for additional revenue steam to keep revenue growth objective. For example, a data monetary research of retail use case from MIS Quarterly Executive demonstrated that getting direct monetary value from a company’s data is no longer elusive.[18]

Data monetization prompted as a hive of term in Google Trends after 2015 [11]. However, its early form can be traceable to retail and market research industries back to a few decades ago. For example Tesco and Nielsen (formerly known as ACNielsen), a global retailer and a global market research firm, has been exchanged their Point of Sales (PoS) data with market research firms for insight service for man years. Nielsen plays roles as both data aggregator and data broker that sell these aggregated insights to manufactures in fast-moving consumer goods (FMCG) industry. The driving force behind this information business is that FMCG manufactures are keen to know more about how their products are sold at different retail channels as well as about their category performance against their competitors. Today, other industries can learn the data monetization strategies from retail industry as data monetization is not long an elusive thinking [18]. It is a new business!

The objective of this study is to deepen our understanding of how data are monetized in industries where many of them either own a variety of data sources or process data that are specifically interesting to other industries.

The three research questions of interest to this study are:
(1) What does data monetization mean to business?
(2) What are types of data monetization and industries currently use?
(3) How to initiate a data monetization strategy?

Scholars from MIS Quarterly identified that big data analytics have become increasingly important in both academic and business communities over past two decades [2]. Given this popularity on discussing big data analytics and technologies, strategic use of big data initiatives such as data monetization is less addressed in academia. This study attempts to further explore in this subject and also provides a direction for industries interesting to tap into data monetization subjects.

PwC-Strategy& estimates that the revenue from commercializing data will ramp up to $300 billion per year in the next three to five years for financial sector alone [21], which echoes the importance of this topic.

This paper is organized as following sequences: (1) introduction; (2) research method; (3) discussion; (4) conclusion.

RESEARCH METHOD
A methodological review of past literature is a crucial endeavor for any academic research [26]. Thus, the literature review and secondary research are chosen as main sources to define data monetization, discover and collect use cases. The literature review of this study was firstly based on the top 50 MIS journals by [15] and then cross-checked with top 109 MIS journals published by Association for Information Systems (AIS) [1]. As a result, 49 out of both MIS journal rankings overlapped were selected. This

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study followed the search approach using literature vendor database indicated by [15] to cover the paper search for these 49 top journals.

In addition, a review protocol to set up to review papers from academic as well as industry communities. In the academic paper review, Google Scholar and electronic scientific database (ACM Digital Library, ABI/INFORM Complete, ScienceDirect, IEEECOMPUTER SOCIETY Digital Library, OmniFile (EBSCO), JSTOR, Wiley BlackWell and Web of Science (Thomson Reuters) are chosen for the reasons of their richness and importance of academic journals. To ensure data consistency and relevance across our collections, only publications contained the keywords “Data Monetization” or “Monetization” within their titles were retrieved. The choice of keywords within titles was intended to focus to search on publications of direct relevance to interest of this study. Only papers published within most recent 10 years (2010-2015) were considered to understand trends.

Considering the nature of data monetization that is often happened in the context of business, research and white papers from industry communities are also considered and reviewed so as to complete this study. In addition, the Google Scholar and Google Search are used as main search vehicles for industry papers. Industry thought leaders of data monetization related domain, such as Accenture, IBM, McKinsey, Author D. Litte, and the Big Four consulting firms (Deloitte, KPMG, E&Y, and PwC) are also included into analysis. Furthermore, only papers published within most recent 10 years (2010-2015) were considered.

**DISCUSSION**

**Definition of Data Monetization**

Gartner research defines “Data Monetization” [20] as using data for quantifiable economic benefit while Wikipedia point out this economic benefit to revenue. It [27] defines “Data Monetization” as a form of monetization generating revenue from available data sources or real time streamed data by instituting the discovery, capture, storage, analysis, dissemination, and use of that data. Both definitions emphasize that economic benefit from value creation is the ultimate purpose.

From the analytic point of view, before data can be monetized, data need to be processed and discovered [16] [18][23]. Data monetization is also a value creation process that need different technologies and business know-how. [16] [18][22][23]. In addition, data monetization is an ability for a business [16][22] and is also a selling process of revenue generation [16][17][18][22]. Worthnotingly, a scholar [22] believes the data source should consider internal and external data sources while another scholar [16] highlights that the directions of monetization can be internal or external to maximize the value creation.

<table>
<thead>
<tr>
<th>Table 1. Synthesis of Data Monetization Definition [16][17][18][22][23]</th>
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</thead>
<tbody>
<tr>
<td>Data Process</td>
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<tr>
<td>Data Discovery</td>
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<tr>
<td>Differentiation</td>
</tr>
<tr>
<td>Value Creation</td>
</tr>
<tr>
<td>Revenue generation</td>
</tr>
<tr>
<td>External &amp; Internal</td>
</tr>
</tbody>
</table>

As a result of synthesis, this study proposes to define data monetization as a value creation and data management capability for a business that can generate additional revenue stream through external insight selling or through internal improvement of operational efficiency.

**Why Data Monetization?**

A global survey by Gartner research [13] estimates that by 2016, 30% of businesses will monetize directly or indirectly their information assets through trade, barter or sale. This is mainly driven by the financial costs of management and emerging opportunities.

While data volumes keep massively growing, the cost and complexity of handling these data challenges make most businesses hang back. Nevertheless, today there are a few forces converging to create condition ripe for data monetization. First at all, the cost of data storage is massively decreasing, and ability to process and analyze huge volumes of data in real time is increasing. For instance, emerging technologies enable real-time execution, and increasing value of Big Data and Analytics [16][22]. Second, Business Intelligence and Analytics (BI&A) now are on the top list of C-suite agendas where they start to recognize the amount of under-utilized data [24]. One scholar [17] believes big data, BI&A and the cloud are three current IT trends that are enhancing the potential for data monetization.
Data Monetization Framework

In the recent special issue of *MIS Quarterly*: business intelligence research, authors [2] proposed a good evolution model for business intelligence and analytics (BI&A), which [2] defined business intelligence and analytics (BI&A) as a related term and treat big data analytics as a related field that offers new directions for BI&A research. Therefore, they further classified the evolution of BI&A into three phases: (1) DBMS-Based, structured content; (2) BI&A 2.0: Web-based unstructured content; (3) BI&A 3.0: mobile and sensor-based content. Apparently, this BI&A evolution model is based on the nature of data.


Since both evolution models are comprehensive as well as widely recognized, this study adapt both model as data monetization framework in the hope to help businesses review their data assets and identify monetization opportunities from data possession points of view. Before data assets can be further used to create value, it worth reviewing the data assets on hands. This study suggests those pursuing a data monetization initiatives to use this data monetization framework as lens to self-diagnose the qualifications and conditions.

Step 1 Analytics Maturity Check: Analytics 3.0 framework can be used as first step to understand the overall analytics maturity for a business to further understand its current state of capabilities, maturity and gaps.

Step 2 Data Asset Check: To deep dive into data assets, this study suggest use BI&A 3.0 framework as second step to backward check if certain asset exist or not as this framework provides a good typology of data associated with analytics capabilities that help a business to define the potential scope of a data monetization.

The gaps identified between two models reflect the reality of conditions as well as insights and implications for the future directions.

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Analytics 1.0</strong></td>
<td>Traditional analytics</td>
<td>BI &amp; A 1.0</td>
</tr>
<tr>
<td></td>
<td>• Primary descriptive analytics and reporting</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Internally sourced, relatively small, structure data</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• “Back room” teams of analytics</td>
<td></td>
</tr>
<tr>
<td><strong>Analytics 2.0</strong></td>
<td>Big Data</td>
<td>BI &amp; A 2.0</td>
</tr>
<tr>
<td></td>
<td>• Complex, large, unstructured data sources</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• New analytical and computational capabilities</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• “Data Scientists” emerge</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Online firms create data-based product and services</td>
<td></td>
</tr>
<tr>
<td><strong>Analytics 3.0</strong></td>
<td>Fast business impact for the data economy</td>
<td>BI &amp; A 3.0</td>
</tr>
<tr>
<td></td>
<td>• Seamless blend of traditional analytics and big data</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Analytics integral to running the business; strategic asset</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Rapid and agile insight delivery</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Analytical tools available at point of decision</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Cultural evolution embeds analytics into</td>
<td></td>
</tr>
</tbody>
</table>

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Liu & Chen
Strategic Directions for Monetization

There are many use cases that demonstrate how different industries can leverage the big data for creating monetary opportunities. This study attempted to summarize these use cases as comprehensive as possible from academic as well as industries researches. The results are as follows:

Table 3. Summary of Data Monetization Use Case  [4][5][7][9][8][10][14][25][18][16][21][20][19][24][22][23]

<table>
<thead>
<tr>
<th>Industry</th>
<th>Monetized Data Use Case</th>
</tr>
</thead>
<tbody>
<tr>
<td>Airlines</td>
<td>• Social network analytics for customer care</td>
</tr>
<tr>
<td>E-commerce</td>
<td>• Online transaction verification</td>
</tr>
<tr>
<td>Financial &amp; Insurance</td>
<td>• Credit/ debit card issuer fraud</td>
</tr>
<tr>
<td></td>
<td>• Auto or claims insurance fraud</td>
</tr>
<tr>
<td></td>
<td>• Branch site selection</td>
</tr>
<tr>
<td>Media</td>
<td>• Out of home advertising measurement</td>
</tr>
<tr>
<td>Real estate</td>
<td>• Real estate analytics- for investment</td>
</tr>
<tr>
<td></td>
<td>• High value prospect for residential brokerage</td>
</tr>
<tr>
<td>Retail/ Brand Supplier</td>
<td>• Mobile and App data analytics</td>
</tr>
<tr>
<td></td>
<td>• Retail location analytics</td>
</tr>
<tr>
<td></td>
<td>• Store visitor analytics</td>
</tr>
<tr>
<td></td>
<td>• Shopping hotspot analytics</td>
</tr>
<tr>
<td>Government</td>
<td>• Infrastructure traffic planning</td>
</tr>
<tr>
<td></td>
<td>• Buildings occupancy</td>
</tr>
<tr>
<td></td>
<td>• City planning- road enhancement</td>
</tr>
<tr>
<td>Tourism</td>
<td>• Tourisms POI analytics</td>
</tr>
<tr>
<td></td>
<td>• First and subsequent visited POI’s</td>
</tr>
<tr>
<td>Telecom-internal use</td>
<td>• Service uptake via Geo-marketing</td>
</tr>
<tr>
<td></td>
<td>• Geo-located CEM &amp; customer care</td>
</tr>
<tr>
<td></td>
<td>• Web Analytics for Customer complaints</td>
</tr>
<tr>
<td>Transportation</td>
<td>• Route analytics for train companies bid</td>
</tr>
<tr>
<td></td>
<td>• for a franchise of a particular route</td>
</tr>
</tbody>
</table>

Table 4. Telefónica- Use Cases for Data Monetization [24]

<table>
<thead>
<tr>
<th>Teleco Data application</th>
<th>Use Case</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retail</td>
<td>Use geo-location data to help retailers to identify new store site and understand customer profiling associated with it</td>
</tr>
<tr>
<td>Train Companies</td>
<td>Usage passenger journey data to assist train companies bid for a franchise of a particular route</td>
</tr>
<tr>
<td>Road infrastructure</td>
<td>the volume of cars on a particular stretch of road at a particular time of day, with added information of the origin and destination of those vehicles to help determine the level of investment in new road infrastructure, junctions and roundabouts etc..</td>
</tr>
<tr>
<td>public sector</td>
<td></td>
</tr>
</tbody>
</table>

Telefónica Example

Telefónica, S.A is a Spanish broadband and telecommunication provider, also one of global leading operator, with 317 million global customers, owning network in 15 countries, operations in 44 countries and 650 roaming agreements worldwide. This global reach has provided Telefónica the advantage of externally monetize its real data for revenue [24].

Telefónica established Dynamic Insights in 2012, a new global business unit aimed at delivering revenue from Big Data, was the first public announcement of a European operator actively engaging in a Big Data initiative that goes beyond in-house processes. Its use case is analyzed and break down by its applications as below. Fore example, Smart Steps service allows a company making more informed decisions on locations by understanding the profile of the true catchment area. There are three use cases from Telefónica [24] illustrating how telecos data are used by other industries: (1) Retail; (2) Training companies; (3) Road infrastructure public sectors.

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How to Initiate Data Monetization Strategy:

Guiding principles
This study reviewed the data monetization related papers from industry thought leaders and summarized several guiding principles based on the similarities and dissimilarities of their methodologies. Of those, strategy, business model, mindset, marketing understanding, data understanding and capability, value chain, roadmap and privacy are most important dimensions considered by these industry thought leaders.

Any business interesting to start with a data monetization strategy may find these perspectives beneficial.

Lessons learned
In addition to points of views from industry thought leaders, a recent research from MIS Quarterly Executive [18] provides several good lessons learned of successful monetarization of data:
1. Consider how creating and sharing data will change relationships and business models.
2. Identify where you currently are in the data monetization journey and where you want to end up with, including preparing your data for sales, assessing the need for value-adding third parties to join the data monetization ecosystem, and marketing your data.
3. Develop contracts to ensure adherence to data monetization policies.
4. Nurture trust between the involved parties.

Table 5. Methodologies in Data Monetization Strategy [9][12][17][21][20]

<table>
<thead>
<tr>
<th>Firms/methods</th>
<th>Accenture</th>
<th>KPMG</th>
<th>Ernst &amp; Young</th>
<th>PwC</th>
<th>Gartner</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategy &amp; business model</td>
<td>Treat the information business as a digital business start-up</td>
<td>Shape your strategies Determine broad business models</td>
<td></td>
<td></td>
<td>Develop a go-to-market strategy that will underpin these new products</td>
</tr>
<tr>
<td>Mindset</td>
<td>Do not think of selling data as an all-or-nothing proposition</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Market Understanding</td>
<td>Find a big-enough sweet spot</td>
<td>Format &amp; additional content (what)</td>
<td>Understand your customers Size the value</td>
<td>Identify the strongest vertical opportunities.</td>
<td></td>
</tr>
<tr>
<td>Data Understanding &amp; Capability</td>
<td>Keep trust with those whose data is used in the product</td>
<td>Decide data genome: discover dis-connectivity and value</td>
<td>Bundle product as a service</td>
<td>Get to know your data Enhance the infrastructure</td>
<td>Select which sets of skills/tools to build in order to create products with economies of scale.</td>
</tr>
<tr>
<td>Value Chain</td>
<td>Manage the information business as a value chain</td>
<td>Measure network effect</td>
<td>Time (when) Availability &amp; interoperability (where) Sharing &amp; Engagement</td>
<td>Understand the value chain</td>
<td></td>
</tr>
<tr>
<td>Roadmap</td>
<td>Scout the road to long-term growth</td>
<td>Enhance roadmap</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Privacy</td>
<td></td>
<td></td>
<td></td>
<td>Anticipate potential privacy issues associated with these products.</td>
<td></td>
</tr>
</tbody>
</table>
CONCLUSION
This study found that data monetization is still a new subject in IS domain and thus it is less addressed on leading IS journals. Yet, interestingly, this subject has been embraced by majorities of consulting firms, if not all. Data monetization also gained popularity among industries owning big data assets, i.e. telecommunication operator, retailer and etc., and information businesses. From the use cases analyzed in this study, results indicates that industry communities see data monetization as an exciting new opportunity that can help create additional revenue stream. In addition, the types of big data application currently used are rich as well as diverse, which sheds lights on how businesses with distinct data assets may unlock the potential of their big data assets.

It is evident to see the growing attentions related to data monetization from consulting firm which implies that these firms see data monetization as a new holy grail for the next future years and will continue to seize the opportunities of being part of in this new data monetization ecosystem, either role played as data specialists, data brokers or both.

Businesses planning to pursue data monetization opportunities may refer to the Data Monetization Framework, use cases, guiding principles and lessons learned proposed by this study to avoid mistakes while start to take action.

In additions, this study believes that there are great opportunities for academic communities to provide more forwarding looking theories and models to help solidify the foundations for data monetization and make this practice more practical. Why? Three reasons. First, data monetization has not gained sufficient attentions from academia. Second, ripping conditions has fueled more opportunities for data monetization as they are now. Third, there is still no universally agreed approach of how to initiate data monetization strategies among industry thought leaders yet. For future research, this subject also implies the research opportunities for IS scholars to tap into the converging information system and strategy domain.

The contributions of this study are twofold. First, this paper contributes to industry communities that start to explore opportunities of creating value from their data assets but lack of directions and how to. Second, this study contributes to raise awareness of academic communities over the potential of big data monetization research.

However, this study is not without its limitation. Despite the efforts made by this study in order to make use cases of data monetization as comprehensive and exhaustive as possible, it is not possible and feasible to collect all during the limit of time frame of this study.

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A REVIEW SYSTEM BASED ON PRODUCT FEATURES IN A MOBILE ENVIRONMENT

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ABSTRACT
With the rapid growth of the mobile commerce, firms have been trying to get their online channels optimized for the mobile devices. However, many contents on online shopping sites are still focused on a desktop PC environment. Especially, consumer reviews are difficult to browse and grasp via a mobile device. Usually, it is not helpful to simply reduce the size of fonts or photos to fit to mobile devices without a fundamental transformation of the review presentation. In this study, we suggest a feature-based summarization process of consumer reviews in mobile environment. Further, we illustrate an implementation of the process by applying opinion mining techniques to product reviews crawled from a major shopping site in Korean. Finally, a plan for a controlled laboratory experiment is proposed to validate the effectiveness of the suggested review framework in this study.

Keywords: Review, Mobile, Usability, Opinion mining, Product features, Summarization, E-commerce.

INTRODUCTION
Mobile commerce continues its rapid growth with a great impact on the global e-commerce environment. According to Criteo report [4], the mobile channel accounts for 34% of e-commerce transactions globally in the fourth quarter of 2015. Mobile share of e-commerce is expected to reach 40% globally by the end of 2015. Especially, mobiles in South Korea and Japan hold over 50% of e-commerce transactions. The increase of e-commerce sites and payment methods that are optimized for mobile devices may be key drivers in the two countries. About 60% of Japanese e-commerce sites support a mobile version [1]. More and more sites become optimized for a smartphone or a tablet globally. However, several e-commerce features such as consumer reviews are still focused on a desktop PC and e-commerce sites are required to change them. They are poorly suited for a smartphone, making contents difficult to navigate. It is unhelpful to simply reduce the size of fonts to fit to small screen size without a fundamental transformation.

Time spent on mobiles exceeds desktop PCs [16]. Mobile users spend 2.8 hours, 51% of total 5.6 hours per day with digital media. Mobile computing is now a part of most people’s daily lives and is complementary to a desktop PC. The numbers of online shoppers using smartphones and desktop PCs are 291.1 million and 333.1 million, respectively [22]. In addition, the number of products which consumers browse via smartphones when going shopping is the same as that via desktop PCs [4]. Consumers use their mobile devices to explore and purchase products even when a desktop PC is nearby [22]. Smartphones are used constantly regardless of where they are. Over 40% of consumers think a smartphone is an important resource for a purchase and about 60% of consumers have used a mobile exclusively when deciding to purchase products [22]. Browsing products from a smartphone has become increasingly common. However, there are disadvantages in the use of a smartphone on e-commerce. Because of physical constraints of a mobile such as small size, navigating via a smartphone can be a huge pain. Although average page views for a mobile and a desktop PC are 8.2 and 9.10, respectively [23], there can be a difference between the amounts of gathered information via a mobile and a desktop PC. For example, suppose that consumers read reviews of a product before making a purchase decision on Amazon.com (Figure 1). Consumers navigating via a mobile spend more time to get the same amount of information compared to consumers using a desktop PC. There are 15 lines vertically in left side of Figure 1 whereas review in right side has just 8 lines and fewer than 8 characters per line. Consumers can see a full review by touching “Read full review” and have to do up and down scrolling frequently. It would be a bothersome task given a great number of reviews. According to Monetate report [23], add-to-cart rate and sales conversion rate for mobile (5.41%, 0.96%) are much lower than for desktop (7.75%, 2.71%). The content form which is not suited for a mobile can be one of the reasons. Thus, the design should be visually simpler and very easy to navigate, effectively providing the information that consumers want to see.

Popular shopping sites such as Amazon.com support mobile version but these sites are focused on fitting to screen size of device. Original photos of desktop version are transformed into smaller photos or the latter part of original product descriptions is omitted according to screen size. This transformation can be applied to mobile version because the amounts of these contents are limited. However, product reviews are different. The length of review is long and the number of reviews is already uncountable on many sites. It is difficult to grasp the whole content via mobile browsing. Mobile consumers can face information overload [27] and browsing loss [8] because they are not able to process the information adequately or the information is not well-organized to understand [12]. Consumers sometimes suffer a trouble in product evaluation even when using a desktop PC [3]. Therefore, current review presentation form on a mobile has to be changed. In mobile environment, it is unsuitable to display detailed review as a desktop version. The appropriate form presenting product reviews is important because product reviews have a great impact.

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on consumers’ purchase decision [6][9][17].

![Image](image.png)

Figure 1. An illustration of the product review on Amazon.com: desktop (left) vs. mobile (right)

Website adaptation to alleviate the problems of frequent scrolling [27] and restricted navigation [24] has been focused on the desktop PC environment. However, content transformation or presentation for a mobile has not been extensively studied. Because of distinct characteristics of a mobile, research in desktop PC environment may no longer be applicable. This paper presents the process of opinion summarization of consumer reviews and explores how to adapt the reviews for mobiles devices effectively. We use a summarization technique to make the optimized form for a mobile. Previous studies report that text summarization in desktop PC environment enables users to find information faster and improve their satisfaction [11][19][20]. We develop a review summarization system which classifies reviews into two types, positive and negative reviews, for each product feature. It consists of feature selection and classifying sentence that contains features. This system provides an overview about product features and a representative sample of each feature as an output. Utilizing the output, we will implement two different review systems, an original review system and a feature-based review system, for mobile users. Finally, we propose an alternative to minimize usability issue for a mobile

**PROPOSED FRAMEWORK**

Opinion mining is the task of finding out user’s opinion, attitude, and emotion towards particular topic [28]. It is performed in sentence [13] or document level [29] and determines whether user’s opinion is positive, negative or neutral about specific subject. A review consists of a subjective sentence or an objective one. Consumers want to know the reasons why the existing consumers like/dislike the product, and sellers are basically interested in consumers’ overall opinions about their products. Thus, most of the existing research on opinion mining are focused on product feature and adjective identification [5][13][26]. However, there are limitations of these existing systems. The accuracy of feature extraction and identification of opinion words is not satisfactory. Thus, the results of classification are not reliable. Identification of product features and opinion words are important tasks in opinion mining. By adding domain knowledge to the existing works, we classify product reviews in sentence level.

Through the results of classification, we aim to investigate the effect of content transformation in mobile environment. Mockup webpages for a mobile can be utilized to explore the impact of content transformation instead of using the actual result of complicated opinion mining. However, mockup webpages are limited to implement actual mobile environment. Limited reviews which are classified manually may not authentically observe user’s actual perception or performance on review summarization for a mobile. Also, most of the limited empirical studies on content transformation on mobiles used emulators of mobiles on desktop PC. Some technical challenges that mobile users suffer can be overlooked when performing tasks. It would be easier to browse using a mouse on an emulator than touching on a mobile. The results of the studies may not truly reflect actual perception and performance on mobile [30]. Therefore, we will use actual review data which are classified by review summarization system and implement a new review system for mobile.

The architectural overview of our review summarization system includes five steps, pre-processing, feature extraction, opinion extraction, opinion classification, and visualization (Figure 2). When users write reviews, they may make errors inadvertently. These errors generally include grammatical, spelling, and punctuation errors. The errors have a negative influence on the performance of the opinion mining because the technique is based on word extraction and linguistic analysis. Opinion mining tasks such as splitting sentence or part-of-speech (POS) tagging [18] are influenced by these errors. Statistical analyses relying on term frequencies are also likely to provide wrong conclusions. Thus, pre-processing crawled data is required prior to beginning review summarization.
DATA COLLECTION & PRE-PROCESSING

Data were acquired in the NAVER shopping site using crawlers. NAVER shopping is the biggest product review website in Korea, collecting all consumer reviews from the representative online shopping sites in Korea such as Auction, G-market and 11st. The acquired data contain product category, product name, price, review, etc. The number of collected reviews is 16,083,512 and we choose a specific category, cream in cosmetics, which has many reviews (394,852). Because of the negative effects of errors mentioned above, it is necessary to eliminate noise of review data as much as possible. Pre-processing comprises sub tasks like spelling check, grammar correction, etc. The goal of pre-processing is not to correct all the errors but to minimize the number of errors. We used spell-check program that is provided by NAVER. About 2.2% of 394,852 reviews is removed because these reviews have encoding errors (e.g., “%amp;”) or meaningless words (e.g., “ekvndkenvirsmut”).

DATA PROCESSING

Feature Extraction

Splitting sentence
A product review consists of several sentences. It contains evaluation of a shopping site, a product, a seller, or delivery. Other factors except product evaluations are external factors because these factors depend on sites selling a product. We focus on the consumer’s product evaluation based on product features. To sort out unnecessary sentences, we need to split user’s review into sentences. After splitting each review, we got 1,039,766 sentences. We parsed each review utilizing linguistic parser which is used in natural language processing (NLP).

Part-of-Speech (POS) tagging
The most fundamental part of the linguistic analysis is part-of-speech tagging. POS aims to label each word with a distinct tag that represents its syntactic position such as noun and verb. Product features exist as a noun or noun phrases in a sentence. POS tagger is important to extract noun or noun phrases. We use Kokoma Korean morpheme analyzer (http://kkma.snu.ac.kr) on each sentence. A revised data file contains a sentence and POS tag information of each word in each sentence. An example is as follows (Table 1).

<table>
<thead>
<tr>
<th>Sentence</th>
<th>POS tagging</th>
</tr>
</thead>
<tbody>
<tr>
<td>This cream product is good for dry skin</td>
<td>This[DT] cream[NN] product[NN] is[VBZ] good[JJ] for[IN] dry[JJ] skin[NN]</td>
</tr>
</tbody>
</table>

Finding frequent features
This step identifies product features on sentence that consumers wrote. In our framework, the process of feature extraction is designed to operate in semi-automation. Some studies try to use a statistical approach to find frequent features [13][31]. The drawback of this approach is that it may extract words which are not related to product attributes. We have proposed a framework which utilizes domain knowledge to frequent features list. There are a lot of nouns or noun phrases in whole sentences. A small part of nouns or noun phrases appears commonly in many sentences and the rest of them are only in one sentence or two sentences.
The Pareto principle (known as the 80-20 rule) may be applied. The number of initial nouns in a cream category was 31,445. We extracted nouns or noun phrases which are high on the list according to Pareto principle. The number of extracted nouns is 204. Especially in Korean, demonstrative, interrogative, personal or reflexive pronouns are classified as nouns. Nouns such as “one”, “two” or “three” are removed. Because consumers mention the name of product category and brand many times, these are also removed. There are still many nouns unrelated with product features in the list. After elimination, the list of nouns left has 75, which is small enough compared to the initial number of nouns and noun phrases. Four persons who have domain knowledge chose nouns or noun phrases which are really related to product attributes out of the 75 nouns or noun phrases. The final list contains 21 nouns or noun phrases.

**Opinion Extraction**

**Opinion words extraction**

We limit to sentences containing product attributes in the final list above because we make a summary of consumer’s opinion on product attributes. The number of sentences that include product attributes is 58,654 among 1,039,766. This step identifies opinion words that consumer expresses a positive, negative, or neutral opinion. Previous research reports that an opinion word is close to a product feature [13]. Also, the presence of adjectives is significantly correlated with subjectivity of a sentence [2]. Thus, we use adjectives and verbs which are near product attributes as opinion words. In total, 61,339 opinion words are selected.

**Opinion polarity identification**

In this step, we identify opinion word’s polarity based on SO-PMI algorithm [29]. This algorithm estimates the semantic orientation by measuring the similarity of pairs of words. When the reference words exists “good” and “bad”, the assumption is that a phrase has a positive semantic orientation when a phrase is more strongly associated with “good”. Choosing the reference words is important when using SO-PMI algorithm. The Dictionaries like WordNet [21] do not include polarity information for Korean words. Thus, we used Korean sentiment dictionary, OpenHangul (www.openhangul.com) based on collective intelligence. According to the frequency of opinion words, we limit to opinion words that appear more than 100 to choose candidates of reference words. In total, 410 opinion words are selected. We determine the polarity of candidates using OpenHangul. There is limited in determining accurate polarity because OpenHangul does not decide polarity with domain knowledge. The four persons who have domain knowledge about e-commerce extracted the most related words because 410 words are small enough to examine manually. After extracting, the positive group has 68 words and the negative group has 38 words. These words are used as a seed list. The goal of this research is not to automate entire processes but to make review pages for mobile in semi-automation. Using SO-PMI algorithm and the seed list, we determined the polarity of other adjectives and verbs.

**Opinion Classification**

**Opinion sentence classification**

After constructing feature and opinion dictionary, we classify each sentence into a positive sentence or a negative sentence. If positive (negative) opinion word appears, the sentence is regarded as a positive (negative) one. However, there may be more than one feature words and opinion words in a sentence. When we make a feature-opinion pair, it is important to know whether this pair is valid or not. We use a naïve method that finds the closest opinion word for a product feature. In this research, we do not consider a “but” clause and a negation word.

Figure 3. Traditional review (left) and feature-based review page (right) for a mobile

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Visualization
Our research aims to investigate the effect of mobile webpage that applies feature-based review classification. Figure 3 gives an example of traditional review page and feature-based review page for mobile. Traditional review page shows each review that existing consumers wrote without any transformation. Feature-based review page provides positive/negative review ratio by product features and shows a representative review about each product feature (Figure 4). If consumers want to navigate more reviews about the product feature, they touch “[more]” next to each product feature.

EXPERIMENT
This study aims to investigate the effectiveness of the suggested review framework through a controlled laboratory experiment with two different mobile webpages. We implement a new mobile website for consumer review system (e.g., Figure 3). The laboratory test minimizes distraction from other factors such as user mobility. Participants are asked to do product purchasing tasks on two different systems via mobile. One of two systems is randomly selected and each participant is randomly assigned to one system.

To evaluate two different systems, we employ three constructs: user perception, information quality and memorability. (1) Perceived ease of use and perceived usefulness are used as measurement of user perception. These are useful to evaluate information systems and user’s intention to adopt them [7][15]. The instruments for perceived ease of use and usefulness are proposed in the technology acceptance model and we adapt from those. Perceived ease of use refers to degree to which consumers think that given system can be used effortlessly and perceived usefulness refers to the degree to which consumers think that given system can improve their task performance. (2) Information quality consists of conforming to specifications and meeting consumer expectations and it is measured by completeness and appropriate amount of information [14]. Completeness refers to the degree to which information is not missing and is of sufficient breadth and depth for the task. Appropriate amount of information refers to the degree to which the volume of information is appropriate for the task. (3) Memorability is a typical dimension of usability [10]. It is used in examining the terms used, labels of displays, etc. When participants complete tasks, they perform a recall memory test. Later, we will find and add other constructs or instruments to evaluate our system more appropriately.

We are currently doing data processing making a new review system for a mobile. After completing data processing, we will implement the mobile web for consumer reviews which works actually. Thus, the experiment will be conducted later.

DISCUSSION
The number of product reviews grows rapidly and there are hundreds of reviews in popular products. A potential consumer may suffer difficulty to decide whether a product is worth purchasing. If consumers purchase a product after reading a few reviews, they may purchase with a biased view. It is also difficult for sellers to keep tracking consumers’ opinion. As the number and the length of review change, a new review system is required. Because a mobile has been widely popularized, accessing the review from smartphones has become increasingly common. Thus, a new mobile version of a review system is necessary. In that sense, our research is timely and pertinent. We propose feature-based review summarization as an alternative to the traditional review system for mobile. We expect to help a potential consumer to make a purchase decision with an unbiased view. Effective presentation of information is crucial for improving consumer experience in mobile environment [25]. Moreover, as a consumer becomes more comfortable with mobile, his/her satisfaction increases [22]. In the perspective of purchase immediacy, about 49% of smartphone consumers want to make a retail purchase within an hour and 67% want to purchase within a day [22]. A potential consumer using a mobile do not want spend much time in shopping. Administrators who are operating online shopping sites should consider how to provide consumers enough information to purchase within a short time. The lack of average page view for mobile shopping has been partly attributed to its usability. Offering a helpful review system to consumers can raise the sales conversion rate in mobile environment. Our research can be extended to easily other contexts in mobile environment.
**ACKNOWLEDGEMENT**

This research was financially supported by Hansung University.

**REFERENCES**


A SOCIO-TECHNICAL SYSTEM PERSPECTIVE OF PSYCHOLOGICAL OWNERSHIP TOWARD SHARING IOT DATA IN SUPPLY CHAINS

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ABSTRACT

Internet of Things can expedite information-sharing between supply chain partners. However, efficient operations within the supply chain may undermine partners’ psychological ownership of shared data. The behavior driven by the feel of ownership may be constrained by social, technical, and environmental factors. This study investigates whether ownership of data may affect willingness to share from the perspective of a socio-technical system. We look into (1) whether the efficiency and adaptability of a supply chain is affected by the possession of data when organizations share IoT data, and (2) whether social and technical systems impact psychological ownership. 302 questionnaires from senior managers of manufactures were collected for analysis. The results show that psychological ownership is positively associated with the efficiency and adaptability of a supply chain and that both social and technical factors enforce it. We also find that social preference can improve the association between a social system and psychological ownership but that technical preference decreases the association between technical system and psychological ownership.

Keywords: psychological ownership, socio-technical system, Internet of Things, supply chain, information-sharing

INTRODUCTION

Internet of Things (IoT) conceptualizes how things are connected through IP. Here, things can be any smart objects, such as vehicles, refrigerators, or living things. Through their connections, things not only have unique identifying characteristics, but also share information in real-time. This new phenomenon raises issues about (1) Internet technologies that connect smart objects, (2) advanced devices that capture and share information, and (3) applications that leverage new business models or platforms. From a system level, those features support device heterogeneity, scalability, ubiquitous data exchange, energy-optimized solutions, location and tracking capabilities, self-organization capabilities, semantic interoperability, and data management. Thus, embedded security and privacy mechanisms are expected [15]. The short to medium term will see the development of applications relating to transportation and logistics, healthcare, smart environments, personal and social aspects, and futuristic domains; in contrast, standardization, addressing and network issues, and security and privacy are open research issues [43]. Such developments synergize the fields of telecommunications, informatics, electronics, and social sciences, but at the same time create greater concerns about data confidentiality, privacy, and trust [15].

This new phenomenon offers opportunities for supply chain management. The automatically-activated sharing of IoT data can provide a high degree of efficiency to supply chain collaboration. With the proper design of decision models, the adaptability of collaboration can be more dynamic. However, this study argues that the ownership of data may pose a concern to both the efficiency and adaptation of supply chain collaboration. In an organization, ownership of data is about possession. Sharing IoT data may challenge the psychology of possession. The psychology of possession is about seeing an object, entity, or idea as “mine” or “ours.” It generally holds that the feeling of possession is equal to the feeling of ownership [33] [44]. In holding ownership, one might consider data as one’s own. The employee consequently develops possessive feelings towards the data and feels more responsible for their quality. However, will feelings of ownership affect the efficiency and adaptability of a supply chain?

This study adopts socio-technical systems (STS) theory, which can be used to explain inter-organizational phenomena [5] [27] [32] [69]. Specifically, the theory looks into behavioral constraints with respect to social, technical, and environmental factors. The concept was developed to measure the interrelationship between humans and machines that constitute the technical and social conditions of work [25]. As employee behavior and work design are interrelated, technical issues cannot be completely understood without involving both social and technical factors [21] [51]. Kull et al. [69] suggest that because supply chain productivity involves both people and organizations, an STS theory describing how organizational outcomes are affected by people in terms of social and technical systems provides a useful perspective. Furthermore, we look into how preference interacts with social and technical systems to influence psychological ownership. We conduct an empirical study on manufacturing firms and their partners. In this study, we focus on the sharing of IoT data between supply chain partners.

BEHAVIORAL SUPPLY CHAIN IN SHARING IOT DATA

A behavioral supply chain seeks to observe human tendencies and influences, such as behavioral biases, cognitive limitations, and individual preferences [42]. It considers how human behavior, which is influenced by cognitive biases, social preferences, and cultural norms, affects performance [8]. Behavior can affect managerial judgment and cause decision-making biases that impact the design, management, and improvement of supply chains [29] [55]. Research has studied the efficiency and adaptability of behavioral supply chains by utilizing, for example, behavioral decision theory, psychological ownership theory, and...
Behavioral decision theory shows that human preferences are neither stable nor complete [11]. Preference construction is a psychological process. Namely, an individual establishes preferences when making a judgment or decision [11]. Preference is hidden in the emotions. It is non-intuitive and is caused by emotional, rather than rational, factors. Preferences may change over time depending on past behavior and experiences [23] [26]. Preferences can notably modify the decision-making process, for example by changing choices [38] [70], even unconsciously [22]. The idea that decision-making is altered by preferences has a considerable influence on cognitive dissonance theory [70]. Thus, preference is an essential factor to consider when examining the efficiency and adaptability of supply chains via IoT.

Psychological ownership refers to feelings of ownership wherein one considers a target or a piece of a target as belonging to oneself. It reflects a state wherein an object (tangible or intangible) is experienced as a part of the extended self [34]. Psychological ownership involves a number of important organizational behavior types, such as feelings of responsibility, stewardship, the assumption of personal risk, organizational citizenship, personal sacrifice, the promotion of and resistance to change, and performance [46]. Each of these behavior types can change the efficiency and adaptability of sharing data in supply chains. It has been found that the psychological ownership has a positive effect on extra-role behavior and is mediated by organizational commitment [17], which is a significant predictor of job satisfaction and turnover intentions [36].

Socio-technical systems (STS) theory provides a framework to analyze interactive processes and relationships between organizations [5] [27] [32]. Socio-technical systems consider an organization to be an open system interacting with the environment. It incorporates consideration of both social and technical systems. A social system includes factors that transcend organizational boundaries to explain partnering behavior types such as beliefs, social networks, norms, and behavior [2] [59]. Vijayasarathy [45] emphasized that social factors such as trust, interdependence, long-term orientation, and information-sharing are crucial factors for an inter-organizational information system. In contrast, a technical system comprises the equipment, methods, and knowledge used by organization to obtain inputs, transform inputs into outputs, and offer outputs or services to customers [72]. Bringing these two types of systems together, socio-technical systems theory was created to analyze how interrelated components affect inter-organizational outcomes in the context of the external environment [69]. STS theory has been applied to many related study domains that involve both human and machines, such as information technology [49], knowledge management [40] [62], manufacturing [71], logistics [16], total quality management [7], organizational development [61], and others. Kull et al. [69] and Vijayasarathy [45] argued that creating superior social and technical systems is fundamental to a firm’s efficiency and adaptability, which in turn is important to the long-term survival and success of supply chains. Moreover, Kull et al. [69] extended STS theory from an individual context to an inter-organizational context.

**THEORY DEVELOPMENT**

In this study, we focus on possession of data, i.e., psychological ownership, rather than commitment to organization and satisfaction, i.e. organizational ownership. It is worth noting that organizational ownership emphasizes qualities of organization-based self-esteem and organizational citizenship [46]. Psychological ownership is contrastingly concerned with an individual’s possession and control of resources [35]. Psychological ownership is shaped by self-identity, efficacy, and having a place to dwell [33]). These are the reasons one experiences the feelings of ownership. Thus, psychological ownership is relevant to the process of sharing information with supply chain members via IoT objects. It is expected that successful sharing requires high levels of organizational commitment [4] [6] [18] [48] [57].

VandeWalle et al. [17] observed a positive relationship between psychological ownership and the frequency with which the members of a firm engaged in extra-role behavior. Millward & Parker [56] studied the importance of competition versus psychological ownership in determining public and private efficiency. Hartley et al. [41] found that changing efficiency reflects the effects of both changes in organizational status and alterations in the market environment.

The primary objective of high efficiency and adaptability is to enhance the performance of supply chains [24] and speed up services to customers [3]. Both are important to respond to the challenges of the environment. Lichocik and Sadowski [24] argued that the measurement of efficiency of activities is the most important element of supply chain management. Similarly, Makris et al. [64] emphasized that adaptability is a key requirement for manufacturing highly reconfigurable products. Thus, the research question is: can the ownership of IoT data affect both the efficiency and adaptability of supply chains?

As both efficiency and adaptability are key measurements of supply chains’ success, we hypothesize that when supply chain partners feel a positive relationship between psychological ownership and identity or commitment, the efficiency and adaptability are enhanced.

H1: Psychological ownership is positively related to efficiency.
H2: Psychological ownership is positively related to adaptability.

As mentioned, socio-technical systems are designed to ensure flexibility by providing employees with a wide range of skills that

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enable high performance in any given situation [21] [66]. A social system can influence firms’ behavior in either formal or informal ways [10]. There are four features of a social system, namely social positions, social values, social associations, and social experiences. Lawler [18] found that a social system supports psychological ownership and long-term commitment. It also provides positive variance and flexibility assurance. If a partner has an excellent social system, psychological ownership intensifies. As such, we hypothesize:

H3: A social system is positively related to psychological ownership.

Similarly, a technical system is about processes, tasks, and technology that are needed for transforming inputs into outputs. There are four features of a technical system, namely technical centralities, technical requisites, technical proximities, and technical flows. In a supply chain, supplier integration is concerned with the partial unification of different organizations’ technical systems [1] [45]. To improve competitive advantage, an integrated IoT system might consolidate the four technical features and provide high-quality technical system integration between supply partners. Ensuing confidence can enhance psychological ownership of employees. Thus, we hypothesize:

H4: A technical system is positively related to psychological ownership.

Preference construction is a psychological process. Preferences are calculated when making judgments and decisions [11]. One’s decisions can be highly sensitive to situational factors that may be unrelated to the actual utility of the course of action. Thus, preferences are not necessarily stable. In fact, preferences are normally hidden and are non-intuitive. They are affected by emotional, rather than rational, factors. Also, preferences are highly influenced by goals, which themselves may change over time. The weights of preference for different performance attributes can vary significantly from member to member [37]. Social preferences refer to the welfare and reciprocation of partners within a supply chain. It focuses on the intrinsic concerns of the other party [9]. Preferences can mediate how the psychological ownership of supply chain members is affected by the social system. Accordingly, we hypothesize:

H5: Social preferences increase the positive effect of a social system on psychological ownership.

Pasmore [72] noted that successful socio-technical systems require adaptation and consideration of human conditions. After learning new information regarding likely outcomes, a firm may change its preferences about actions [20]. When a new partner enters a cooperative relationship, they will be affected by the firm’s status and its relationship with its partners. This is especially the case when using IoT to enhance efficiency by integrating systems. The partners may have different statuses, and they may be unfamiliar with the system and insist on using an outdated system. These technical preferences may undermine psychological ownership. Thus, we hypothesize:

H6: Technical preference decreases the positive effect of a technical system on psychological ownership.

**RESEARCH METHOD**

To develop a survey instrument, a pool of items for measuring the constructs of the research model was identified from the literature. Given that sharing information via IoT to supply chain partners is a new approach for most firms, we revised the terms used in the literature to communicate effectively with our respondents. The items and sources are listed in Table 1.

**Content Validity**

As our respondents preferred to answer questions in Chinese, we translated the items from English and then retranslated into English. The retranslated English version was checked against the original version to ensure accuracy. The items were measured on a seven-point Likert scale, ranging from ‘strongly disagree’ (1) to ‘strongly agree’ (7).

A pre-test was performed on a sample comprising four academic researchers and four Ph.D. students. Then, several large manufacturing firms were contacted for the pilot-test. The respondents were asked to complete the questionnaire and provide comments on the wording, clarity, and overall appearance and content of the instrument. The responses suggested that all statements could be retained and that only minor cosmetic changes were needed. After further review by two other academic researchers, the instrument was ready to be sent to a large sample to gather data.

<table>
<thead>
<tr>
<th>Construct</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Social System</strong></td>
<td></td>
</tr>
<tr>
<td>SS1 My firm shares information with supply chain partners.</td>
<td>[68]</td>
</tr>
<tr>
<td>SS2 We'll help each other to complete our tasks.</td>
<td></td>
</tr>
<tr>
<td>SS3 We'll timely explain our goals</td>
<td></td>
</tr>
</tbody>
</table>

**Technical System**

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<table>
<thead>
<tr>
<th>Construct</th>
<th>Description</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>TS1</td>
<td>We'll ensure flexibility in our processes to meet customer’s needs.</td>
<td>[67]</td>
</tr>
<tr>
<td>TS2</td>
<td>We'll plan our processes and technical activities needed.</td>
<td></td>
</tr>
<tr>
<td>TS3</td>
<td>We'll achieve the necessary technical requirements in the organization by rewards.</td>
<td></td>
</tr>
<tr>
<td><strong>Social Preferences</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SPR1</td>
<td>You would treat fairly to your supply chain partners.</td>
<td></td>
</tr>
<tr>
<td>SPR2</td>
<td>We will abide by the norms of each other.</td>
<td></td>
</tr>
<tr>
<td>SPR3</td>
<td>We will care for each other.</td>
<td>[49]</td>
</tr>
<tr>
<td><strong>Technical Preferences</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TPR1</td>
<td>We can provide highly respected products and services.</td>
<td></td>
</tr>
<tr>
<td>TPR2</td>
<td>We will continue to look for new ways to improve work efficiency.</td>
<td></td>
</tr>
<tr>
<td>TPR3</td>
<td>We will adapt quickly to new work requirements.</td>
<td></td>
</tr>
<tr>
<td><strong>Psychological Ownership</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PO1</td>
<td>You and your supply chain partners consider that this is your supply chain.</td>
<td>[46]</td>
</tr>
<tr>
<td>PO2</td>
<td>You and your supply chain partners sense that this is your supply chain.</td>
<td></td>
</tr>
<tr>
<td>PO3</td>
<td>You and your supply chain partners are very easy to image that this relationships are own for yourself.</td>
<td></td>
</tr>
<tr>
<td><strong>Efficiency</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EF1</td>
<td>We are able to maintain a certain growth rate of sales</td>
<td>[47] [50]</td>
</tr>
<tr>
<td>EF2</td>
<td>We consider that our return on investment is improved.</td>
<td></td>
</tr>
<tr>
<td>EF3</td>
<td>We consider that our ratio of outputs on inputs is improved.</td>
<td></td>
</tr>
<tr>
<td><strong>Adaptability</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AD1</td>
<td>We consider that our new products can improve the percentage of sales.</td>
<td>[13] [14] [50]</td>
</tr>
<tr>
<td>AD2</td>
<td>We consider that we able to solving problems creatively.</td>
<td></td>
</tr>
<tr>
<td>AD3</td>
<td>We consider that the ability of learning new tasks, technologies, and procedures is improved.</td>
<td></td>
</tr>
</tbody>
</table>

**Data Collection**
This study sought to select respondents with the greatest knowledge about the operation and management of the cooperative relationships between their manufacturing firm and its suppliers or subcontractors. Based on the literature and recommendations from practitioners, it was decided to select functional managers who are on the senior management team and are involved in maintaining and developing cooperative relationships with suppliers or subcontractors of the firm. We reached out to the top 2500 manufacturers listed in the directories of the China Credit Information Service. In an effort to maximize the response rate, a modified version of Dillman’s total design method was followed. A survey package including (1) a cover letter explaining the research objectives, (2) the questionnaire, and (3) a stamped, return-addressed envelope, was sent to managers of each firm. To make the process as convenient as possible, participants were offered options to return the questionnaire by either mail or fax. In the first two weeks, we called corporate executives to ask whether they would participate. After the telephone calls, 1326 questionnaires were sent out. Two weeks after the initial mailing, personalized reminder e-mails were sent to all potential participants. Those who did not respond to the initial mailing received a reminder telephone call three to four weeks later. A total of 302 usable responses from function managers or other managers in the senior management team were received. This resulted in a sample size of 302 for a response rate of 22.8%. A Chi-square analysis of the industry distribution of the respondents showed no difference in industry distribution of the firms used in the survey.

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A STUDY OF ONLINE BEAUTY COMMUNITY MEMBERS’ VOICES: EWOM TEXT MINING

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ABSTRACT

The Internet promotes the development of the social media, these new media offer open platforms for participants to share product/service reviews with each other. This study applied the theory of conformity behavior to explain online community members’ information consumption behaviors by using text-mining techniques. NetBeans7.4 was used to conduct Chinese tokenization and data analysis. Next, factor analysis and correlation analysis were conducted to reduce the attribute size of products. Our findings demonstrate that more attributes a product/brand has more discussions found in an online community. The conformity phenomenon is seen in help to accumulate sufficient and complete eWOM to reach a sufficient quantity. Thus, brand is more likely to be mentioned. However, the few brand vendors with high product strength have the impact of conformity, in which, may result in a lower spread power with wrong marketing strategy. Therefore, we argue that the reputation bias generated by conformity will make a misleading purchase decision. Based on the conformity effect of eWOM, we establish the effectiveness of text mining technology applied to information search platform design and brand marketing strategy. Implications were proposed in the final section.

Keywords: electronic word of mouth, conformity behavior, information social influence, text mining.

INTRODUCTION

Nowadays, more and more people surf new media to gather product information, particularly, online reviews or electronic word of mouth (eWOM) before shopping. Compared to product recommendations of brand vendor, consumers tend to accept the experience sharing in online community. Asia belongs to collectivist country, a conformity phenomenon in Taiwan is more obvious. "Consumer voice" will be more valuable when under the influence of social media and online community.

There are 38.8% people in Taiwan adopt eWOM of skin care products [28]. Conformity behavior theory is widely used in financial issues, such as funds, the securities market, or discussion on personality and behavior of consumers, and rarely for beauty maintenance area. Past research topics are mainly focused on how conformity behavior affects consumer attitudes and behavior or explore the factors of conformity behavior[9][18][22][23]. However, a few studies used data-driven techniques to analyze customers’ voice based on the theory of conformity behavior[15]. Previous studies examined customers’ perception based on query-driven techniques, such as questionnaires and experiments[22][23], which might miss hidden trends and cues. To fill the gap, this study analyzed 2 years eWOM communications’ influence on members’ information consumption behaviors.

Therefore, we applied the theory of conformity behavior to explain online community members’ information consumption behaviors by using text-mining techniques. Factor analysis and correlation analysis are used to extract primary factors of eWOM communication. The posts and replies of community members’ comments are defined as “voice of customers”.

Conformity Behavior

In Asch ‘s seminal studies [2][3][4][5], the individual in the group who tend to change his/her decision to match that of the group’s. They wanted to go along with the crowd, even the decision is incorrect and contrary to his/her own understanding. There are different point of view to define a conformity behavior. Social psychologists believe that conformity behavior is a social behavior generated by groups [1]. Base on the perspective of asymmetric information, economic scholars argue that individual ignore personal information and copy the behavior of others expressing a less effective behavior [6][7]. Investors will affected to make a decision which conflicted with their own opinion by crowd psychology [16], and that will generate excessive volatility. In the field of marketing, researcher focus on the social influence of consumer behavior. Therefore, we define a conformity behavior is “consumers will change their intention and behavior for the purpose of obtaining the social identity” [19][27]. In other words, consumers use reference groups as a guide to revise their consumption decision process.

Deutsch and Gerard (1955) reinterpreted social influence by differentiating between informational and normative social influence. Informational social influence describes when individuals face with time constraints, possesses limited knowledge or perceives high risk in the action, they will observe others behaviors and access the information as an important source for their own choice. Normative social influence describes individuals will adjust their identity, attitudes and behavior to correspond with the attributes of their social groups, and conforms to the expectations of important others in order to receive a reward or avoid a punishment. In brief, the former is “influence to accept information obtained from another as evidence about reality,” the later refers to "the influence to conform to the expectations of another person to group". Much past studies have shown out the influence of "informational social influence” and "normative social influence” on consumers’ purchase decision in the traditional marketing, which 80% consumers purchasing decision come from the comments of specific persons or groups [26]. The impact of the conformity phenomenon on purchasing decisions has been extended to virtual environment [9][15][22]. When consumers face uncertainty case, consumers will depend on eWOM under the information social influence result in conformity behavior. While

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internet without boundaries and immediacy, information can be quickly spread to online community, consumers become more likely to be affected and imitate others’ choice by normative social influence (eg. tourist attraction, official recommendation, celebrity endorsements or hot sell product, consumers tend to buy the same product or brand). Thus, compared to the traditional word of mouth, the effect of eWOM is more extensive and significant [13]. Previous studies have demonstrated whether male or female consumers both have significant conformity behavior [23]. Positive and negative eWOM have different effects on consumer decision-making with the degree of participation [18].

**eWOM and Conformity Behavior**

Consumers browse experience and evaluation of products through the Internet, and they can share their experiences, ideas and knowledge with others in specific topics. The information what they share is called ‘eWOM’, also referred to ‘online word-of-mouth’ [17] or ‘word-of-mouse’ [12]. Compared to traditional marketing, online shopping behavior is more complex, consumer has information searching behavior before buying [17]. The purchase decision process of consumers changes from passive(attention, interest, desire, memory, action, AIDMA) into active (attention, interest, search, action, share, AISAS).

Park and Mittal (1985) points out that consumers search different characters of information depend on their buying purpose. As the number of online evaluation increase(eg. number of comments, the degree of concern, and the extent of the discussion), consumers’ purchase intentions increase [21]. Therefore, we suggest that consumers will search eWOM aggressively based on their personal motivation or demands, and the conformity behavior will generate under the influence of eWOM. Hence, the following hypotheses are proposed.

**H1:** If there have more keywords are mentioned from eWOM, then have more keywords are involved in topics, which lead more higher informational conformity behavior.

**H2:** If there have more brands are mentioned from eWOM, then have more brands are involved in topics, which lead more higher informational conformity behavior.

EWOM communication is like a dendritic structure. The rate of participate is an exponential growth which has much more influence. Bone (1995) argued that when two (or more) views of the message are the same, the eWOM effects are higher than a single one. In other words, when there have more participants involved in online community, the eWOM has more impact on their behavior [25]. Thus, we argue that when eWOM communicated through the participant interaction, which may, in turn, affect the online members' behavior. Hence, the hypotheses is proposed.

**H3:** If there have more participants in the topic, then more replies and cumulative brands discussions are generated, which lead more higher informational conformity behavior.

According to previous conceptual and empirical literature, we build the research model by using the concept of informational conformity behavior [11](see Figure 1).

![Figure 1. Research Model](Image 1)

**METHODS**

Text mining refers to the process of deriving high-quality information from text, also referred to as data mining. Shapiro(1991) define text mining to be a method to extract previously unknown and potentially useful information from numerous unstructured or semi-structured data. Text mining has been used widely in unstructured documents (such as blog, community etc…). In this study, text mining is used to extract core keywords for understanding “consumer voice”.

**Data Collection**

The market research survey report indicates FashionGuide is the online beauty community which has a great number of visits in Taiwan. The online community has richness eWOM and interaction, more than sixty thousand items beauty care products published, product evaluation accumulated more than one million, a discussion more than eight million. There are various beauty care products’ categories, include lotion, essence, eye cream, lip balm, etc. The number of mask use in Taiwan has more than 95 million (Nielsen 2014). We focus on ‘facial mask’ and mining related topic discussed online. Two years data were collected from...
an online beauty community in Taiwan, which is categorized as collectivist country as other Asian countries culture. The official identity, sponsored brand and bloggers identity and some related topics were removed.

Data Analysis

![Flowchart of Analysis Methods](image)

NetBeans7.4 and SPSS19 were used to conduct Chinese tokenization and data analysis. Next, factor analysis and correlation analysis were conducted to reduce the attribute size of products(Figure 2). HTML(Hyper Text Markup Language) is the standard markup language used to create web pages. Unstructured file has a problem of data diversity that is difficult to analyze. So before Chinese tokenization, we convert message into TXT (text) format, in order to facilitate the subsequent steps. We create ‘mmseg4j’ and ‘artificial’ thesaurus for tokenization, then remove meaningless words by human check. The accuracy rate of MMSEG algorithm is as high as 98.41%. The mmseg4j combine ‘sogou’ and ‘rmmseg’ thesaurus, which has more than 14 million words [24]. The thesaurus is supplemented by using artificial methods to enhance the integrity, such as the brand and complete hyphenation. Unnecessary or meaningless words (eg. the official label, single word, unrelated products) are removed in the final step. By the semantic integration of product related words,196 keywords are captured from 5,510 terms. Next, the amount of discussion more than 40 is selected to perform cross over analysis between keywords and brands. Based on cross-comparison between keywords and brands, the keywords which has more than 40 discussions will be selected as the primary keywords of online community member discussion.

Second Step, principal component analysis is used, which follow the rule mentioned by Kaiser(1960). The result shows there has eigenvalues(>1) and proportions of variance for the seven potential factors(see Table 1). 78.163% of the variance in our items was explained by the 7 extracted components. After rotation the components together account for 78.163% of the total variance. Table2 displays rotated component matrix which variables load on components after rotation. All factors loadings should be greater than 0.7 (less than 0.7 are removed), and the components are named by group (see Table3).

<table>
<thead>
<tr>
<th>component</th>
<th>Initial Eigenvalues</th>
<th>Factor analysis</th>
<th>Correlation analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial Eigenvalues</td>
<td>Extraction Sum of Squared Loadings</td>
<td>Rotation Sum of Squared Loadings</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>% of Variance</td>
<td>Cumulative%</td>
<td>Total</td>
</tr>
<tr>
<td>3</td>
<td>2.622</td>
<td>12.484</td>
<td>50.112</td>
</tr>
<tr>
<td>4</td>
<td>2.125</td>
<td>10.117</td>
<td>60.229</td>
</tr>
<tr>
<td>6</td>
<td>1.180</td>
<td>5.621</td>
<td>72.833</td>
</tr>
<tr>
<td>7</td>
<td>1.119</td>
<td>5.330</td>
<td>78.163</td>
</tr>
</tbody>
</table>

Table1. Potential factors (Eigenvalues>1)
Table 2. Rotated Component Matrix

<table>
<thead>
<tr>
<th>Component</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inexpensive</td>
<td>.924</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>buy one, get one</td>
<td>.896</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>special price</td>
<td>.879</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Price</td>
<td>.875</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Obedient</td>
<td>.831</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Function</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flavor</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stimulate</td>
<td></td>
<td>.938</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Allergy</td>
<td></td>
<td></td>
<td>.924</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Composition</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maintenance</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Absorb</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Essence</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thick</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Whitening</td>
<td></td>
<td></td>
<td></td>
<td>.868</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moisturizing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.840</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Repair</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.760</td>
</tr>
<tr>
<td>Bright</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fresh</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.810</td>
</tr>
<tr>
<td>Snail</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sheet</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.886</td>
</tr>
</tbody>
</table>

Table 3. Naming the Factors

<table>
<thead>
<tr>
<th>Component</th>
<th>Named</th>
<th>Attribute(Keywords)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factor 1</td>
<td>Price</td>
<td>Inexpensive, Buy one-get one, Special price, Price, Obedient</td>
</tr>
<tr>
<td>Factor 2</td>
<td>Composition</td>
<td>Stimulate, Allergy</td>
</tr>
<tr>
<td>Factor 3</td>
<td>Essence</td>
<td>Absorb, Essence, Thick</td>
</tr>
<tr>
<td>Factor 4</td>
<td>Function</td>
<td>Whitening, Moisturizing</td>
</tr>
<tr>
<td>Factor 5</td>
<td>Repair</td>
<td>Repair</td>
</tr>
<tr>
<td>Factor 6</td>
<td>Fresh</td>
<td>Fresh</td>
</tr>
<tr>
<td>Factor 7</td>
<td>Sheet</td>
<td>Sheet</td>
</tr>
</tbody>
</table>

In the final stage, we hope to provide advice for marketing, R&D and advertising through further analysis. The keywords have appeared in more than twenty topics will be selected for this stage, in which do the correlation analysis between keywords. Table 4 shows that if lift>1, there are a positive correlation between keywords; if lift=1, there are a independent events between keywords; if lift<1, the relationship between keywords is negative [29].

Table 4. The correlation coefficient between keywords and brands (unit:%)

<table>
<thead>
<tr>
<th>Brand</th>
<th>Attribute1</th>
<th>Support</th>
<th>Confidence</th>
<th>lift</th>
<th>Attribute2</th>
<th>Support</th>
<th>Confidence</th>
<th>lift</th>
<th>Attribute3</th>
<th>Support</th>
<th>Confidence</th>
<th>lift</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Moisturizing</td>
<td></td>
<td></td>
<td></td>
<td>Whitening</td>
<td></td>
<td></td>
<td></td>
<td>Inexpensive</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brand1</td>
<td></td>
<td>38</td>
<td>68</td>
<td>2</td>
<td></td>
<td>36</td>
<td>72</td>
<td>2</td>
<td></td>
<td>36</td>
<td>84</td>
<td>2</td>
<td>...</td>
</tr>
<tr>
<td>Brand2</td>
<td></td>
<td>26</td>
<td>46</td>
<td>2</td>
<td></td>
<td>26</td>
<td>52</td>
<td>2</td>
<td></td>
<td>25</td>
<td>58</td>
<td>2</td>
<td>...</td>
</tr>
<tr>
<td>Brand3</td>
<td></td>
<td>21</td>
<td>38</td>
<td>2</td>
<td></td>
<td>20</td>
<td>40</td>
<td>2</td>
<td></td>
<td>21</td>
<td>49</td>
<td>2</td>
<td>...</td>
</tr>
<tr>
<td>Brand4</td>
<td></td>
<td>17</td>
<td>30</td>
<td>2</td>
<td></td>
<td>18</td>
<td>36</td>
<td>2</td>
<td></td>
<td>17</td>
<td>40</td>
<td>2</td>
<td>...</td>
</tr>
<tr>
<td>Brand5</td>
<td></td>
<td>15</td>
<td>27</td>
<td>2</td>
<td></td>
<td>14</td>
<td>28</td>
<td>2</td>
<td></td>
<td>14</td>
<td>33</td>
<td>2</td>
<td>...</td>
</tr>
<tr>
<td>Brand6</td>
<td></td>
<td>14</td>
<td>25</td>
<td>2</td>
<td></td>
<td>13</td>
<td>26</td>
<td>2</td>
<td></td>
<td>11</td>
<td>26</td>
<td>2</td>
<td>...</td>
</tr>
<tr>
<td>Brand7</td>
<td></td>
<td>18</td>
<td>32</td>
<td>2</td>
<td></td>
<td>19</td>
<td>38</td>
<td>2</td>
<td></td>
<td>18</td>
<td>42</td>
<td>2</td>
<td>...</td>
</tr>
</tbody>
</table>
RESULTS

eWOM and Informational Conformity Behavior

Text mining is used to verify the conformity phenomenon from eWOM. We find a positive correlation exists between product/brand attributes and quantity of discussion in the online beauty community. When more product / brand attributes keyword involved from eWOM, it will lead more topic discussion related to the product / brand. The quantities of keywords discussion display that active product / brand attributes in the topic will affect the community members to focus on the keywords discussion. Table 5 shows there are more product attributes mentioned, has more informational conformity behavior, such as ‘Moisturizing’, ’Whitening’, ’Inexpensive’ and’ Function’; On the contrary, the keywords only be mentioned in specific topics, has less informational conformity behavior, such as ‘Sheet’ and ‘Repair’.

On the other words, more numbers of participants in online community, more valuable information will be cumulative in related topic, include replies, keywords and discussion (See Figure 3). For example, the replies and interaction in topic NO. 25 are more intense than other topic, it will lead to increased conformity behavior (H1~H3 is supported). There has the same result from the point of view of the brand. Brand1 has most adequate buzz, and most significant and widely discussed in various topics; conversely, the lower degree of buzz has a lower effect on conformity behavior(see Figure 5).

Table 5. Keywords statistic

<table>
<thead>
<tr>
<th>Attributes (Keywords)</th>
<th>Quantities of discussion</th>
<th>Cumulative keywords from topic</th>
<th>Attributes (Keywords)</th>
<th>Quantities of discussion</th>
<th>Cumulative keywords from topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisturizing</td>
<td>23</td>
<td>97</td>
<td>Obedient</td>
<td>2</td>
<td>50</td>
</tr>
<tr>
<td>Whitening</td>
<td>12</td>
<td>88</td>
<td>Composition</td>
<td>2</td>
<td>50</td>
</tr>
<tr>
<td>Inexpensive</td>
<td>11</td>
<td>76</td>
<td>Allergy</td>
<td>2</td>
<td>40</td>
</tr>
<tr>
<td>Function</td>
<td>10</td>
<td>95</td>
<td>Stimulate</td>
<td>2</td>
<td>31</td>
</tr>
<tr>
<td>Essence</td>
<td>6</td>
<td>72</td>
<td>Snail</td>
<td>1</td>
<td>31</td>
</tr>
<tr>
<td>Maintenance</td>
<td>5</td>
<td>67</td>
<td>Buy one-get one</td>
<td>1</td>
<td>36</td>
</tr>
<tr>
<td>Price</td>
<td>4</td>
<td>66</td>
<td>Thick</td>
<td>1</td>
<td>28</td>
</tr>
<tr>
<td>Sheet</td>
<td>4</td>
<td>40</td>
<td>Bright</td>
<td>1</td>
<td>38</td>
</tr>
<tr>
<td>Special price</td>
<td>3</td>
<td>52</td>
<td>Fresh</td>
<td>1</td>
<td>33</td>
</tr>
<tr>
<td>Repair</td>
<td>3</td>
<td>48</td>
<td>Flavor</td>
<td>1</td>
<td>28</td>
</tr>
<tr>
<td>Absorb</td>
<td>3</td>
<td>47</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure3. Statistic of topic
Figure 4. Statistic of topic

Figure 5. Statistic of brand

Figure 6. Cluster Analysis
The statistic result shows that there are three major factors ‘Price, Essence and Function’ always be focused on by community members. The relationship between brands and factors assessed from cluster analysis results are discussed. The results illustrated in Figure 6-7 indicate there has significant differences in ‘Price’ and ‘Function’ factor. Compared to other brands, community members are satisfied with the price and promotion strategy of Brand1; in addition, they tend to consider functional value of the product of Brand2. The results mean that consumers are very sensitive to price volatility; second, ‘Moisturizing’ and ‘Whitening’ are primary demands of consumers.

Figure 7. Cluster Analysis

Figure 8. A dendritic structure of eWOM
eWOM System

According to the results, popular keywords and brands may be discussed in a high frequency, online community members will repeatedly seek such topics and result in the conformity behavior (Figure 8). In view of this, we simulated eWOM system with the feature of conformity(Figure 9–10). There are three blocks of interface design, the left column is the product items, the right column is the product keywords (including keywords, brand and self-searching function), in the middle of the block is the topic display. This system provide a sort function by analysis of posting date and replies. It display topics according to users’ demands, and calculate the popular keywords as an information guide for displaying content of each main topic. However, the system can be added the theme of the keyword ratio analysis charts, that provide users quickly understand what information the topic has. In the context of replies, ‘text mark’ conducive for convenience of information searching and browsing, further reduce their search time.

<table>
<thead>
<tr>
<th>Date</th>
<th>Theme</th>
<th>Replies</th>
<th>Keywords</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014/08/12</td>
<td>Affordable whitening mask.</td>
<td>7</td>
<td>Whitening</td>
</tr>
<tr>
<td>2014/08/07</td>
<td>The first use of this product.</td>
<td>20</td>
<td>BeautyDiary</td>
</tr>
</tbody>
</table>

Figure 9. Interface and Keyword Searching Mechanism

Figure 10. Subject Browsing
CONCLUSION

Our findings demonstrate that more attributes a product/brand has more discussions found in an online community. When the amount of information discussed to reach a sufficient quantity, brand is more likely to be mentioned. In other words, when the product/brand covers more attributes, the more chance to be seen, which was affected by conformity phenomenon occurred during eWOM delivery process. The phenomenon is seen in help accumulate sufficient and complete information of eWOM.

When community members focus on a few brands mentioned frequently, consumers will realize that they get effective purchase information, and rationalize their purchase decisions. Consumers no longer receive media messages passively in the current media environment. They tend to avoid uncertainty and perceived risk of pre-purchase information search others experience or popular degree of products. In an attempt to promote brand discussions degree and exposure, most brand vendors decided to take in cooperation with the blogger / internet celebrity / keyword advertising, or title sponsor with the broadcast. However, domestic information search interface is most design by using the amount of click and comments, which easily lead to erroneous information touted and advertising proliferation exaggerated.

Based on the findings above, the effect of eWOM on purchase behavior is no doubt. However, the few brand vendors with high product strength have the interference of conformity phenomenon, may result in a lower spread power with wrong marketing strategy. Therefore, the reputation bias will make a misleading purchase decision. Based on conformity with eWOM, we establish the effectiveness of text mining technology applied to information search platform design and brand marketing strategy. Platform vendors can do detailed industry analysis toward information topics, and add search engines / label / text prompts mechanisms with keywords extraction. Brand vendors will get richer hidden market information from the text mining results, whereby connect brand and product attributes for building brand association.

We recommend that future studies can further explore the impact of positive and negative eWOM of conformity behavior; Second, do cross over analysis to find the differences between "opinion leaders" and "eWOM User" message content; Third, use computing performance mode for the correlation analysis with the content of the information search platform (product attribute keywords), then provide guidelines for eWOM users "which topics have higher knowledge value? (the maximum amount of information/ the most adequate keywords)"; Fourth, use the mining result to improve information search platform or electronic catalog label.

REFERENCES


The Fifteenth International Conference on Electronic Business, Hong Kong, December 6-10, 2015

69
This study integrated the concepts of conformity tendency and perceived playfulness into the technology acceptance model to explain why people continue to use an SNS.

This study used structural equation modeling (SEM) to evaluate the causal relationship between variables in the structural model.

1. The results indicated that SNS perceptions of ease of use and usefulness both significantly affected usage attitudes and intentions.
2. The results also suggested that perceived playfulness helped to increase user intentions to continue using SNS; a high degree of perceived ease of use promoted perceived playfulness, thereby improving attitudes and intentions.

This study analyzes the nonconformity under local nonconformity and a global nonconformity. The former is a behavior related only to the social circle of each agent, but not to the whole population. This concept means that a nonconformist agent takes the majority opinion of its social circle, but it prefers to have the same opinion of majority of the population.

By analyzing complex topologies of the agent network (scale-free networks & small-world networks).

The result is that conformity is an important behavior in these dynamics as it strongly affects the outcomes of the proposed model.

This study investigates the effects of negative online consumer reviews on consumer product attitude.

The elaboration likelihood model is used to explain the persuasive effect of the proportion and quality depending on product involvement.

1. Consumers conform to online consumer reviews and their attitudes become unfavorable as the proportion of negative online consumer reviews increases.
2. High-quality negative online consumer reviews influence consumer attitude more than low-quality negative online consumer reviews.
3. The degree of negative change in the attitude towards a product as a result of low-quality and high-quality negative online consumer reviews is greater for high-involvement consumers than for low-involvement consumers.
4. The proportion of negative online consumer reviews could be a central cue to high-involvement consumers because of the recommendation role of online consumer reviews. A simple negative recommendation can influence the attitude of consumers under high-involvement condition as well as under low involvement condition.

<table>
<thead>
<tr>
<th>[22]</th>
<th>This study examines shoppers' buying behaviour when exposed to a high, low or no number of previous purchases on a daily deal website, and whether this behaviour is different when the shopper is influenced by the snob or bandwagon effect.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Shoppers were exposed to the same daily deal website, offering the same product, with only the number of purchases manipulated—high, low, or no information.</td>
</tr>
<tr>
<td>2.</td>
<td>A pre-experimental test with six students, who were a sub-sample of the main sample, was conducted to ensure some rules.</td>
</tr>
<tr>
<td>3.</td>
<td>Post-experiment, respondents were measured on their need for uniqueness using a nine-item Likert-type scale.</td>
</tr>
</tbody>
</table>

1. Study 1: The need for conformity/uniqueness as having an effect on purchase likelihood. The bandwagon/snob effect can influence purchase likelihood.
2. Study 2: The purchase likelihood continues to increase for services as they are increasingly discounted is contrary to previous studies that have looked at services in more traditional price promotion contexts.

<table>
<thead>
<tr>
<th>[23]</th>
<th>This study investigate if and how people conform when using the Internet, exercising social influence only via computer-mediated communication (CMC).</th>
</tr>
</thead>
<tbody>
<tr>
<td>A quasi-experimental approach</td>
<td>This study found the conformity in a CMC context and a social presence felt. In particular, for male, the result indicated that one's self-esteem could play an important role in the desire to keep an image of oneself as knowledgeable and able to reason logically.</td>
</tr>
</tbody>
</table>
A STUDY OF THE COSTS OF CLOUD-BASED WEBSITE PARALLEL ARCHIVING SYSTEM

David Chao, San Francisco State University, dchao@sfsu.edu
Sam Gill, San Francisco State University, sgill@sfsu.edu

ABSTRACT
Parallel Archiving System supports web applications that are periodically renewed, frequently changed in design and supporting technologies, and are required to keep the previous periods’ applications operational in parallel with the current period application to form an easy-to-access archive for historical data. The system implements each period’s application with a virtual machine to preserve the technologies and deploys it in a cloud platform. This paper studies the costs of a cloud-based Parallel Archiving System that include the cost of virtual machine, database server, data storage, business transactions and website traffic. This study will help a manager in determining how many of previous periods’ applications an organization can afford to run for a given budget.

Keywords: Cloud computing, parallel archiving, website archiving, virtual machine cost.

INTRODUCTION
Many business applications are designed and organized to support business activities for a period of time and to be renewed at the turn of the period akin to the perpetual seasonal change and renewal of nature. This period of time may be a year, such as applications supporting the operation of a fiscal year, or a quarter or a season such as applications supporting a university’s semester or quarter. During the operational period, the design of applications such as user interface and supporting technologies are rarely changed to assure smooth operation. Design changes are typically implemented in a revision of the application that supports future periods. When a change of period occurs, the application is reinitialized to support the new period and the application and the data of the previous period become archival.

Very often the applications supporting the previous periods need to be operational continuously even after the application for the new period started. First, they are needed to process incomplete transactions from the previous periods. Two types of updates may occur to data of previous periods: 1. Retroactive corrections: These are corrections to data of previous periods after periods ended. 2. Anticipatory insertions: These are data of the previous periods that have not been entered during those periods. Second, they are needed for informational purposes. Historical data are useful for decision making and their value tends to decrease as it becomes older. The data of the recent periods have higher value and are accessed more often. Allowing users to access historical data through a familiar interface is better than redirecting users to other unfamiliar archive locations and updated data will be available for analysis and decision making. Therefore, it is beneficial for applications supporting previous periods to operate in parallel with applications supporting the current period.

Parallel operation of current and previous periods’ applications may be problematic for web-based applications. Due to the rapid change in Internet technologies, websites must keep themselves up-to-date by adopting new technologies. The infrastructure of a dynamic website typically includes the operating system, the web server, the database management system, and the server-side computer language used to create the dynamic pages, collectively known as the “stack”. Two examples of such stack are the Microsoft stack with Windows, Internet Information Service (IIS), SQL Server, and a .NET language; and the LAMP stack with Linux, Apache, MySQL, and PHP. It is possible that the infrastructure of the current period application may not be compatible with that of the previous periods.

We proposed a cloud-based parallel archiving scheme in [3] to support the parallel operation of the current period and previous periods’ applications. The proposed scheme applies two advancements in information technology: virtualization and cloud computing. Virtualization allows organizations to create IT environments that can respond to dynamically changing demands for computing resources. The proposed scheme supports each period’s application in a virtual machine with all the supporting technologies so that the technologies are preserved with the application. The virtual machine is retained for a number of periods set by the organization’s policy and eventually retired and its data permanently archived.

The scheme is cloud-based to take advantage of the efficiency that cloud computing has to offer. Cloud computing delivers computing resources “as a service” to clients via Internet [9] and does not require businesses to invest heavily on IT infrastructure out-front. The major benefits of cloud computing includes [4]: 1. Efficiency: Cloud computing allows businesses to rapidly deploy applications due to lower requirements for initial investment on technologies and maintenance of the infrastructure. 2. Agility and innovation: Businesses can react to the business environment faster and test innovative services before full-scale implementation. 3. Cost Savings: Businesses only pay for the computing capabilities they use without purchasing the infrastructure, and can determine the computing capabilities dynamically based on the demand of the applications. 4. Increased scalability: Businesses can rapidly "scale up” their computing capabilities, and rapidly release those services to quickly "scale in.”

The proposed parallel archiving scheme uses virtual servers of a cloud platform to run each period’s application and its stack in a virtual machine so that previous periods’ applications will run in parallel with the current period system and forms an easy-
to-access archive for historical data. This scheme is good for applications with the following properties: 1. the applications are periodically renewed, 2. previous periods’ applications are required to be operational after new period starts, 3. the applications may change in terms of design and supporting technologies from period to period, but remain unchanged during the period. This paper studies the costs of the cloud-based parallel archiving system, and is organized as follows. Section 2 presents an introduction to the design of the system. Section 3 studies the costs of the proposed system. Section 4 concludes the paper.

PARALLELL ARCHIVING SYSTEM DESIGN

Figure 1 presents an overview of the parallel archiving system. The core of the system is a Virtual Host System consisting of a collection of virtual host servers running on a cloud platform. Each virtual host server operates a collection of virtual web servers. We consider a web server as a system defined by the four components of the stack: the host operating system, O, the web service, S, the database management system, D, and the server side web language, L; the stack remains unchanged in a period. Each web server hosts one website that runs the application of a specific period. So there exists a one-host server/many-web server relationship, and one-web server/one-website relationship. We assume a website, WS, has a life of N periods and will be retired at the end of the Nth period. Let i denote the i-th period since a website starts, then a website may have a remaining life, R, of N - i + 1 periods. The parallel archiving system eventually will have N websites operating in parallel, each with N - i + 1 periods remaining life where i ranges from 1 to N. Websites can be distinguished with these attributes, WS(Stack(O, S, D, L), R).

Users of the system initiate business transactions and submit queries related to a specific period. The Seamless Login Module enables transparent login to each website regardless of underlying server structure. It presents users with an easy-access interface where websites are accessible by push buttons. Once in the website, data of business transactions and queries are handled by the Website Data Manager. Since there are N websites operating in parallel, these Website Data Managers are in fact managing the archived data of these N periods.

The function of the DS/DW Integrator is to gather and prepare data for an enterprise’s decision support system and data warehouse. Recognizing the value of business intelligence to an enterprise, today’s e-Commerce systems typically integrate decision support data acquisition module in the system design [7]. Because of the heterogeneous nature of the virtual machines and websites, the DS/DW Integrator must have the ability to work with heterogeneous data sources.

A website will eventually retire when it completes its N life periods and will be removed from the Parallel Archiving System. The website with its supporting technologies and database is a valuable historical resource of an enterprise. Historical data may be useful in supporting applications that require historical data, such as applications that perform analyses to study certain trends in the study subject, or answering questions about website content in the past for audit and compliance purposes. Websites may also be required to preserve historical data due to government or organizational policies. The Website Archiving Integrator implements the enterprise’s policy in archiving websites. One popular practice is periodically creating date-time stamped read-only copies of the website. In cloud computing this can be done by creating the virtual machine snapshots.

An Example of the Virtual Host System

Figure 2 gives an example of the Cloud Virtual Host System assuming the website has been running for four years and renewed every two years with a new stack. The Parallel Archiving System assumes a one-virtual host server/one-website relationship. Each year the website is running on a separate virtual host server. The arguments supporting the one-virtual host server/website relationship are:

1. Application periodic renewal:

   - Applications are renewed periodically.
   - New applications are operational from the start of each period.

2. Support for varying design and technologies:

   - Applications change in terms of design and supporting technologies from period to period.
   - These changes do not occur during each period.

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server/one-website relationship are: 1. assuring the current operational system running smoothly without interruptions from other activities is the primary objective of an information system. 2. It will ease the management of the parallel archiving system. As discussed earlier, a typical cloud computing platform offers services to take snapshot and create image of a virtual machine. With each period’s system running on a separate virtual machine, it will be easier to create snapshot and the image of the virtual machine for that period. 3. There exists unbalanced demand for each period. The demand for the previous periods will decrease as time elapsed. Since a virtual machine can be activated/deactivated by the client of a cloud computing platform, to save the costs of running the parallel archiving system, an organization may activate the previous period systems on an on-demand basis.

![Cloud Computing Platform](image)

Figure 2. An example of the Cloud VM Host System

COSTS OF PARALLEL ARCHIVING

This section studies the costs of the parallel archiving system. We assume the system is running in a public cloud platform. Examples of such platform include Microsoft Azure [6], Google Cloud [5], Amazon EC2 [1] and many others. These vendors offer virtual machines with these services: 1. They offer an extensive list of pre-configured virtual machine images encompassing a wide range choice of operating systems, database management systems and development technologies. 2. Users are able to create their own virtual machine images with user-specified configurations. 3. Users can upload and deploy their own virtual machine images. 4. Users can activate and deactivate the virtual machines as needed. 5. Users can take snapshots of the virtual machines which is a file-based representation of the state of a virtual machine along with the database at a given time. Virtual machine snapshots help to back up or archive virtual machines. 6. Users can capture an image of a running virtual machine as a template to create other virtual machines. These services let users to customize virtual machines to their requirements, control the costs of deploying the virtual machines and create backups of the virtual machines.

Cloud computing vendors typically adopts a Pay-As-You-Go pricing policy [8]. And they charge services for: 1. Virtual machines, for the time each one is running. 2. Database server. 3. Storage for files. 4. Web traffic between the user's browser and the website. 5. Interaction with the storage system generated by the business transactions. 6. Connectivity between the cloud platform and client's on-premises IT infrastructure. The first three of the charges are fixed costs once the virtual machine is configured and are the charges for the computing stack. And the other charges are variable costs that depend on the volume of business transactions.

There are many factors affecting the amount of computing stack charges. Factors relevant to the parallel archiving including:

1. Virtual Machine processing capacity. For example, Microsoft Azure offers a variety of virtual machines including A-series general purpose virtual machines, D-series virtual machines feature solid state drives and faster processors than the A-series, and G-series virtual machines feature faster processor, more memory and four times more Solid State Drive storage than the D-series. The average price of the D-series is about 1.7 times more expensive than the A-series, and the average price of the G-series is about 5.45 times more expensive than the D-series.

2. Database server capacity. For example, Microsoft Azure offers SQL Server Standard tier with mid-level performance, and Premium tier designed for mission-critical databases. The average price of the Premium tier is about 41.4 times more expensive than the Standard tier.

3. The support of scalability. Cloud platforms support scalable applications that can rapidly "scale up" their computing capabilities, and rapidly release those services to quickly "scale in." One such example is the Cloud Service offered by Microsoft Azure [6]. A cloud service is a multi-tier web application in Azure, consisting of Web Roles which are dedicated virtual machines for hosting front-end web applications, and Worker Roles which are dedicated virtual machines that run time-consuming tasks sent from a web role asynchronously in the back-end. And the number of Web Roles and Worker Roles can be configured dynamically based on the business needs.

4. Decreasing demand for aged websites. The need for the aged websites to be online will decrease and hence do not need to be online at all time. Cloud platform vendors let users to activate and deactivate the virtual machines as needed. A further cost reduction can be achieved by running aged websites intermittently only at a fraction of time such as daily from 9 to 5 or weekly on certain weekdays.
Determining The Length of A Website’s Life

The Parallel Archiving System assumes a website has a life of N periods and the system is running N periods of websites in parallel. The actual value of N may be influenced by many factors such as an organization’s policy in accepting delayed changes and the budget to support the parallel historical websites. In the following analysis we study the impact of budget to the value of N by comparing the budget to run the current period website and previous N-1 historical websites.

The current period website is considered to be the mission-critical application. Assuming the application is scalable that will dynamically scale up or down between a preset value of Max/Min number of virtual machines. Let \( p_i \) be the probability that \( i \) virtual machines are used to support the current period website where \( \text{Min}\leq i\leq \text{Max} \), then the expected number of virtual machines used is:

\[
n = \sum_{i=\text{Min}}^{\text{Max}} i \cdot p_i
\]  

A manager may study the website’s operational history to get an estimate for \( p_i \). In this study we assume a simplified scenario where all \( p_i \)s are assumed to be equal to illustrate our analysis. Under this scenario, the \( N = \frac{\text{Max}+\text{Min}}{2} \). The demand for each historical website will decrease and is small enough to use only the Min number of machines to support. Let \( f \) be the fraction of the cost to run a historical website relative to the cost to run the current website, then \( f \) is:

\[
f = \frac{\text{Min}}{\frac{\text{Max}+\text{Min}}{2}}
\]

Let \( r \) be the ratio of the budget to run the non-current N-1 websites and the budget to run the current website, that is \( r = \frac{\text{Budget for the N-1 non-current websites}}{\text{Budget for the current website}} \), then \( N = 1 + \text{Floor}(rf) \) where Floor function rounds down to the nearest integer. Note that this formula, \( f \) can be rearrange as:

\[
f = \frac{2}{1+\frac{\text{Max}}{\text{Min}}}
\]

So, \( f \) is smaller when the ratio of \( \frac{\text{Max}}{\text{Min}} \) is large and hence the value of \( N \) becomes larger for the same ratio of \( r \). This indicates that when the value of \( \frac{\text{Max}}{\text{Min}} \) is large it will be cheaper to run the historical websites. And when \( r \) is small, the value of \( N \) becomes smaller. This is because less budget is allocated to run historical websites.

If the application is not scalable, then the same virtual machine configuration is used in every period. The cost can only be reduced by running the application intermittently. For example, if the application is run every day from 9 to 5, then the virtual machine charge will be 1/3 of the current website. If it is run Monday to Friday from 9 to 5, then the virtual machine charge will be 23.8% of the current website. The value of \( N \) can be determined based on the ratio \( r \).

**CONCLUSION**

This paper presents a Parallel Archiving System for web applications that are periodically renewed, frequently changed in design and supporting technologies from period to period, and are required to keep the previous periods’ applications operational in parallel with the current period application. An example of an application with these characteristics is a university’s learning management system supporting faculty and students that may be renewed every academic period while...
allowing users to access previous periods’ data. We study the costs of running such system in a cloud platform. We find that the system is capable of keeping a non-current website longer in the system if the cost of running a non-concurrent website in the cloud is less expensive; also if more budget can be allocated to run non-current websites. We continue to study the costs of the Parallel Archiving System.

REFERENCES

A STUDY OF VIRTUOUS CYCLE OF SERVICE PARTICIPATION ON CROWDSOURCING PLATFORMS
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ABSTRACT
Competition has undoubtedly increased substantially over the last decade for several reasons. The Internet has been far and away the largest contributor to the rise in competitive markets due to establishing an online business has lower operating costs and greater flexibility. Companies must have internet business ideas to survive to stay competitive in today’s markets. Crowdsourcing is a phenomenon receiving highly attention both inside and outside of academia. With the rapid development of Web2.0 and social media, an emerging business model like a raging fire impacts on the market: a crowdsourcing platform. Crowdsourcing platforms provide a good environment to fulfill people’s needs and seize value from providing products and services. It is important to understand what drives people to deliver and capture values from a crowdsourcing platform. The purpose of this paper is to explore how service participation works on successful crowdsourcing platforms in their cycles. We focus on why do participants (both sides of supply and demand) are willing to join into the platform to provide services and request services, finding out their virtuous cycles on the platforms in different applications.

This study is the first of its kind to explore how service participation works on successful crowdsourcing platforms in their cycles. We will use a qualitative multiple case study, which facilitated an exploration of the phenomenon in an area that has received little theoretical development and allowed us to study the cycle of service participation on crowdsourcing platform in a real-life context. The results may reveal us some significant driving factors on why people are willing to provide and request services on crowdsourcing platforms and what important strategies should be taken while running a crowdsourcing platform. This not only gives us a more broaden view of crowdsourcing and platform operating, but also provides companies, which use crowdsourcing platform to run their business, a more realistic decision making references.

Keywords: Crowdsourcing platform, Crowdsourcing, Platform, Virtuous cycle, Service participation, Critical success factor (CSF), performance indicator, key performance indicator (KPI)
AN ANALYSIS OF OPEN-SOURCE SMARTPHONE MARKET: PRELOAD APPS AND CO-COMPETITION
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ABSTRACT
Free open-source operating system (OS) has driven both ad revenue and Internet traffic from smartphones to the historically high levels. Though achieving huge market share, there is no record showing that the profit of a handset maker from the smartphone market can surpass the firm implementing vertical integration ever since the first smartphone has been launched in the market. In this study, we consider that an open-source OS provider free offers its operating system but gain mobile advertising revenue by demanding the hardware maker to install preload apps. After trading off between homogenizing each open-source smartphone but gaining more “eyeball shares” on advertising via handsets due to more preload apps, we examine how the OS provider’s optimal agreement with hardware makers changes with market factors. In addition, we also compare and analyze the profit of the OS provider between launching its own brand of smartphones and receiving advertising revenue only. Our results suggest that the OS provider should enhance the quality of its own product when entering the smartphone market. Moreover, if outsourcing the production work to a hardware maker can achieve the economies of scale and increase its profit, our analytic results suggest that the OS provider shouldn’t partner with the hardware maker dominating the smartphone market.

Keywords: in-app ads, vertical integration, operating system, outsourcing, production differentiation

INTRODUCTION
In the first quarter of 2015, market surveys have reported that the traffic volume and advertising revenue contributed by Android has first time surpassed iOS. For increasing its market share rapidly to grow mobile ad revenue, Google, in control of developing and maintaining Android, doesn’t charge any hardware makers installing the open-source operating system (OS). However, hardware makers have to follow certain requirements, known as Mobile Application Distribution Agreement (MADA), regulated by Google; otherwise, some popular services and apps which are viewed as key components (such as APIs and Google Play) in the ecosystem of Android cannot be offered in their smartphones. In recent years, both mobile search results and YouTube ad revenue have surged up because mobile platforms have become a major channel to connect the Internet. The requirements which specify how many Google apps have to be preloaded and where these gadgets are placed significantly link to the open source OS provider’s profit.

To incentivize hardware makers to follow the placement standard of apps and create more ad revenue form preloaded gadgets, Google has also shared a part of its advertising revenue with hardware makers. The details of sharing ratios are often not disclosed, but many news reports are available to shed light on the contexts. Intuitively, the hardware maker having high market share should be able to demand more from advertising revenue. Moreover, from the perspective of providing consistent experience in the manipulation of software and raising more advertising revenue, an open-source OS provider may want to require more pre-load apps on the home screen of smartphones; however, such a requirement may reduce the hardware makers’ profits because product differentiation is more difficult to be achieved as the open-source OS provider increase the number of pre-load apps and demand more prominent position for them. Once these smartphone products become more homogeneous, less differentiation will lead to fierce competition in price among hardware makers, which may decline the open-source OS provider’s mobile ad revenue eventually.

Launching its own brand of smartphone to acquire higher profit from the smartphone market could be a lucrative alternation for an open-source OS provider. In addition, this means can offer software developers a platform featuring an updated version of operating system for testing, encourage hardware makers to adopt the newest standards, and gain more “eyeball shares” on mobile advertising by making the open source OS become universally accessible. However, such a strategy of releasing its own product, achieved by either outsourcing or vertical integration, may endanger the partnership between the open-source OS provider and hardware markers, and even intensify the competition among hardware makers. Interestingly, Google’s smartphone and tablet are also co-developed and manufactured by the hardware makers in the market, as shown in Table 1. Moreover, though the market share of iOS is less than 15% in recent years, it is reported that Apple’s revenue from iPhone accounted for 89% of all smartphone profits. Considering such a marvelous instance and the fact that the market share of Android has increased to more than 80%, building its own brand of smartphone is a “worthy of imitation” strategy for Google to expand its profit other than mobile advertising revenue.

From the perspective of mobile advertising and smartphone sales, there are two research questions worthy to be further analyzed. First, how would an open-source OS provider adjust the number of pre-loaded apps to enhance its profit in a fairly competitive environment? We aim to investigate the impact of advertising revenue and the number of hardware makers on the optimal agreement concerning pre-load apps. Second, we prescribe the condition under which it is profitable for an open-source OS provider to make its own brand of smartphone. Finally, we analyze the open source OS provider’s decision of outsourcing from the
viewpoint of co-competition relationship between the open-source OS provider and the hardware maker delegated to manufacture the open source OS provider’s product.

<table>
<thead>
<tr>
<th>Brand Name</th>
<th>Product Type</th>
<th>Release Date</th>
<th>Manufacturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nexus One</td>
<td>★ Smartphone</td>
<td>2010</td>
<td>HTC</td>
</tr>
<tr>
<td>Nexus S</td>
<td>★ Tablet</td>
<td>2010</td>
<td>Samsung</td>
</tr>
<tr>
<td>Galaxy Nexus</td>
<td>★ Smartphone</td>
<td>2011</td>
<td>Samsung</td>
</tr>
<tr>
<td>Nexus 4</td>
<td>★ Tablet</td>
<td>2012</td>
<td>LG</td>
</tr>
<tr>
<td>Nexus 7</td>
<td>★ Tablet</td>
<td>2012</td>
<td>ASUS</td>
</tr>
<tr>
<td>Nexus 10</td>
<td>★ Tablet</td>
<td>2012</td>
<td>Samsung</td>
</tr>
<tr>
<td>Nexus 5</td>
<td>★ Tablet</td>
<td>2013</td>
<td>LG</td>
</tr>
<tr>
<td>Nexus 7 (2nd Generation)</td>
<td>★ Tablet</td>
<td>2013</td>
<td>ASUS</td>
</tr>
<tr>
<td>Nexus 6</td>
<td>★ Tablet</td>
<td>2014</td>
<td>Motorola Mobility</td>
</tr>
<tr>
<td>Nexus 9</td>
<td>★ Tablet</td>
<td>2014</td>
<td>HTC</td>
</tr>
</tbody>
</table>

**LITERATURE REVIEW**

The quality of Apps and the content presented by them are the most critical in shaping the satisfaction of smartphone users [6]. In fact, apps and web services themselves are even more important than the operating systems on smartphones because they may replace the home screen of an operating system or offer a direct connection through the Internet [10]. Though granting a high profit sharing ratio can encourage more app developers to join the platform and then leads to more sales, Fukawa and Zhang [3] show that the strategy may be helpless and even harmful to the open source OS provider when its market share is higher than a certain threshold. From the perspective of Google, it will be a top priority that ensuring high ad-click-through rate by requiring the number of preload apps on each android handset, which are able to put users on its search interface [5].

From the perspective of methodology used in this study, differentiated Cournot model has been widely applied to various different contexts concerning the competition between firms selling substitutes. For instance, Wang [13] considers a duopolistic setting to prescribe the conditions under which the firm with a cost-reducing innovation gains more from royalty licensing than a one-off payment. Milliou and Petrakis [8] examine how the date of adopting a new technology changes with the level of product differentiation. Tang et al. [9] indicate that high production cost and the advantage of scope economies are major driving forces for outsourcing production work to third parties.

Strategic outsourcing is a global tendency in the manufacturing industry because this strategy can save cost and achieve higher performance by delegating the manufacturer with comparative advantage against in-house production. Shy and Stenbacka [12] find that economies of scale can be achieved in an oligopolistic input-producing industry structure because firms will outsource to the same manufacturers. Xia and Gilbert [14] consider the scenario in which a supplier delegates a retailer to sell two substitutable products and the supplier can provide demand-enhancing services by itself or outsources the service to the retailer. Their results indicate that the decision of outsourcing is linked to the firm acting as a Stackelberg leader. Rothaermel et al. [11] highlight the importance of balancing vertical integration and strategic outsourcing because their empirical results show that achieving a balance in taper integration can increase competitive advantage and improve firm performance.

From the perspective of market structure, our research model is similar to the one analyzed by Foros [2], which investigates the competition between two Internet service provider and shows that a vertical integrated ISP controlling the access network may foreclosure an ISP connecting to the network by overinvesting in value-added services when its R&D in offering the services surpasses the other. From the perspective of advertising, Giri and Sharma [4] consider the aspect of sharing advertising expenses for enhancing consumer demand in a supply chain consisting of one supplier and two competition retailers. By investigating the upper’s decision on whether to share its retailers’ advertising costs and whether to levy different wholesale prices from them, their numeral results demonstrate that differentiating the wholesale prices is always beneficial to the supplier. Yao et al. [15] consider two heterogeneous value-adding retailers in a supply chain, both of which pay the same wholesale price to their common supplier and only know their individual cost of value-added service. Their results show that both retailers, which are cost inefficient, are willing to share their cost information with the supplier when the market demand is large enough. On the other hand, the private information will be hidden when both have cost advantage. From the view of oligopolistic competition, Bagchi and Mukherjee [1] study a supply chain with differentiated oligopoly in which a supplier can adopt royalty licensing or auction its licenses to retailers. Their results indicate that the supplier prefers royalty licensing than auction when the number of retailers is not too small and the degree of production differentiation is moderate.

Our model differs from prior studies in that the open source OS provider plays the role of a supplier but only receives advertising revenue from hardware makers, which are similar to the retailers in supply-chain literatures. In addition, the supplier can share its

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advertising revenue with the retailers and regulate the degree of production differentiation by specifying the number of preload apps and the location where the apps can be accessed. Moreover, we also examine the benefit of strategic outsourcing to one of the retailers rather than outside manufacturers when the supplier establishes its own brand of handset.

**THE MODEL**

Consider an OS provider and two hardware makers in an open-source smartphone market. According to the agreement with the OS provider, both hardware makers can use its operating system without any charge but have to install the apps appointed by the OS provider on the home screen of their handsets. As a result, the OS provider can make a profit from the in-app ads delivered through its preload apps even if there is no payment from the release of its developed operating system. However, once more preload apps are demanded by the OS provider, the less degree of production differentiation the hardware makers suffer from. Therefore, the OS provider has to trade off its advertising revenue from mobile advertising and the competition between hardware makers.

To model the relation among the OS provider and two duopolistic hardware makers, a stylized Cournot differentiated model is used to analyze how the OS provider base various market factors to adjust the requirement of its preload apps on the home screen of handsets. Though smartphone users can also use the apps provided by the hardware makers or install other apps by searching in an app market, we consider that the probability of using the preload apps on the home screen is higher than others and therefore focus on the impact of the number of preload apps appointed by the OS provider on its profit. For simplicity, we let the ratio of preload apps on the home screen handled by the OS provider is $u$ and the hardware makers $1 - u$, respectively. The parameter $u$ not only captures the ratio of advertising revenue from apps between the OS provider and either hardware maker but also represents the degree of production differentiation. Thus, letting $q_i$, $i = 1, 2$, be the quantities produced by hardware markers $i$, the inverse demand function in the open-source smartphone market is given by

$$p_i(q_i, q_j) = a + q_i - q_j - uq_i,$$

for $i^\neq j$. (1)

where $a$ represents market profitability [7] and $q_i$ measures individual maker’s product competitiveness [2]. As the ratio of preload apps on the home screen increases, the market becomes more homogeneous because all open-source handsets have similar appearance and functionality on their home screen when consumers make their first glances on the products.

**Optimal Production Differentiation**

In practice, after following the OS provider’s requirement, hardware makers can still preload their apps on the rest of space to gain their own advertising revenue; in addition, the OS provider may consider sharing its advertising revenue with hardware makers to strengthen their partnership and encourage them to strategically accommodate their products to the preload apps required by the OS provider. Therefore, letting $g$ be the ratio of advertising revenue taken by the OS provider and $b$ the marginal advertising revenue per demand, the profits of the hardware makers can be expressed as

$$p_i = (p_i - c)q_i + b(1 - g)uq_i + b(1 - u)q_i,$$

where $c$ is marginal production cost. Though it seems more reasonable that all smartphone makers have different marginal production cost, we simplify the issue because a heterogeneous setting doesn’t alter our qualitative results. Here, the value of $g$ is considered as an exogenous variable because the negotiation of how much advertising revenue to be split may involve the setting of bargaining power, which is absent in our model. Moreover, the profit of the OS provider is given by

$$p_s = b\frac{g}{1 + u} \frac{u}{\lambda} q_i.$$ (3)

Based on backward induction and the static analysis on the optimal ratio of preload apps with respect to advertising revenue, we have the following findings:

**Proposition 1. (The impact of advertising revenue on the number of preload apps)**

When the demand of advertising increases or the hardware maker’s share of advertising revenue decreases, the optimal number of the preload apps required by the OS provider decreases. Formally, if $\frac{u}{\lambda} > b < 0$ and $\frac{u}{\lambda} \frac{g}{b} < 0$.

Our results indicate that the OS provider should consider allowing its partner to preload more itself apps when advertising revenue increases, no matter whether the advertising price increases or the OS provider has a higher share of advertising revenue from a new agreement. Thus, this finding reminds the OS provider of the importance of balancing product differentiation and in-app ad revenue. Recently, Google’s advertising revenue declines year by year; however, the intention of gaining more advertising revenue from in-app ads is not just simply to arbitrarily increase the number of preload apps because this blind move without understanding the influence of product differentiation on the smartphone market may erode its profit margins eventually.

Subsequently, we consider there are $n$ hardware makers in the smartphone market. Thus, the inverse demand function in the smartphone market is refined as

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\[ p_i(q_i, q_i) = a + q_i - q_i - u \theta \frac{\partial}{\partial x} q_i \quad , \]

To analyze how the OS provider dynamically update its agreement with hardware makers when the number of hardware makers in the market increases, we consider all the makers have the same product competitiveness (that is \( q_i = q \) for all \( i \)).

**Proposition 2. (The impact of market competition on the number of preload apps)**

From the perspective of profitability, as more hardware makers enter this open-source smartphone market, the operating system provider should require the less number of preload apps to allow higher level of production differentiation. Formally, \( \frac{\partial q_i}{\partial n} < 0 \) given in a homogeneous equilibrium.

In order to grow its user base and increase advertising revenue, this result shows that the OS provider can regulate the level of production differentiation by decreasing the number of preload apps on the home screen when more and more hardware makers launch their products in this market. Though it seems that the strategy will reduce the OS provider’s advertising revenue, allowing hardware makers to deploy more apps according to their product positioning can facilitate better production differentiation, which turns out to be benefit to the OS provider.

**CO-COMPETITION**

By outsourcing or vertical integration, the OS provider may also launch its brand of handset to grow its business in the smartphone market. In the current version, we assume that all preload apps are regulated by the OS provider and the degree of production differentiation is exogenously given; however, the inconsistency will be improved in the future revision. Therefore, following the same inverse demand curve given in (1), if the OS provider chooses not to launch its own brand of smartphone, its profit and the profits of the hardware makers are

\[ p_{g,N} = b \theta \frac{\partial}{\partial y} q_i \quad \text{and} \quad p_i = (p_i - c)q_i + b(1 - g)q_i \quad (5) \]

If the OS provider decides to launch its own smartphone in the market, the new inverse demand curve is given by

\[ p_i(q_i, q_i) = a + q_i - u \beta \frac{\partial}{\partial x} q_i \quad (6) \]

As a result, the profit of the OS provider can be expressed as

\[ p_{g,Y} = b \theta \frac{\partial}{\partial y} q_s + (p_s - c)q_s \quad \text{and} \quad \frac{\partial p_{g,Y}}{\partial \beta} \frac{\partial q_s}{\partial \gamma} + (p_s - c)q_s \quad (7) \]

Comparing \( p_{g,Y} \) with \( p_{g,N} \), we have the following findings:

**Proposition 3. (The condition on production competitiveness for vertical outsourcing)**

When the product competitiveness of the OS provider’s smartphone is not too weak, releasing its own brand of handset to the market is better than serving as a pure OS provider. Formally, \( \pi_{g,Y} > \pi_{g,N} \) when \( \theta_1 = \theta_2 = \theta_3 \).

When the OS provider’s production cost is the same as the other hardware makers, our result shows that the OS provider should always launches its product to the market as long as its product quality is not too low as compared with the products launched by the others. Even if the strategy may annoy its downstream partners and lead to more intensive competition, our finding helps explain why Google still releases its own brand of smartphone and tablet in the market. In the following, the static analysis is implemented to investigate the impact of market factors and the share of advertising revenue on the OS provider’s profit.

**Proposition 4. (The comparison in profit between vertical specification and vertical outsourcing)**

(1) When \( a \) is smaller than a certain threshold, \( \frac{\partial \pi_{g,Y}}{\partial a} < \frac{\partial \pi_{g,N}}{\partial a} \)

(2) When \( \theta_1 = \theta_2 = \theta_3 \), \( \frac{\partial \pi_{g,Y}}{\partial c} > \frac{\partial \pi_{g,N}}{\partial c} \) and \( \frac{\partial \pi_{g,Y}}{\partial a} < \frac{\partial \pi_{g,N}}{\partial c} \)

Our results indicate that low production cost and high market profitability are two important factors of supporting the decision of vertical outsourcing. Though releasing its own brand of smartphone makes each firm gain less profit from the consumers, gaining the dual profit made up of the sales of its product line and advertising revenue maintains comparable advantage against receiving mobile ads revenue only as the produce cost decreases or market profitability increases, as shown in Figure 1 and 2. However, when the market profitability is not high enough and all smartphones have symmetric product competitiveness, we find that the OS provider should not enter the smartphone market when the share of the hardware makers’ advertising revenues from the OS provider’s preload apps is too low, as shown in Figure 3. The results remind the OS provider of the importance of enhancing its operating system and the quality of preload apps to attract more potential buyers because a small market cannot feed so many hardware makers in a highly competitive ecosystem. Finally, though we cannot directly examine the impact of marginal advertising revenue on the OS provider’s profit when it launches or not, the numerical result shown in Figure 4 is consistent with our intuitive perspective that high advertising revenue motivates the OS provider to release its own brand of handset in the market.

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Outsourcing Strategy
Subsequently, we consider the scenario in which the OS provider has decided to launch its product and outsource the production work to one of the hardware makers due to cost consideration. The hardware maker having the order from the OS provider may leverage economies of scale to reduce production cost and even earn additional profit from the OS provider. In such a complicated relationship, the OS provider doesn’t only directly compete with the hardware markers in the smartphone market but also become an important tactic partner from the perspective of outsourcing. For simplicity, the hardware maker taking the order from the OS provider may charge \( w_i \) per quantity and its marginal production cost can be reduced to \( c - e \) due to the benefit resulting from large-scale production. We consider that the OS provider can always delegate an original equipment manufacturer (OEM) to produce its smartphone and the OEM charges \( c \) per quantity, which is a very competitive price because it is not higher than other hardware maker’s marginal production cost. Accordingly, in the scenario of outsourcing, the profit of the hardware maker \( i \) receiving the order is given by

\[ p_i = p_i q_i + b (1 - g) q_i (c - e) q_{g,i} + w_i q_{g,i}, \]

where \( q_{g,i} \) is the quantities of the OS provider’s smartphone when outsourcing its order to hardware maker \( i \). As for the OS provider, its profit in the scenario of outsourcing can be expressed as

\[ p_{g,i} = (p_g - w_i) q_{g,i} + b \left[ (q_i + q_j) + q_{g,i} \right]. \]
The outsourcing process of the OS provider is as follows:
(i) The OS provider outsources its production work to either hardware maker 1 or 2.
(ii) The hardware maker decides the outsourcing cost per quantity $w_i$.
(iii) The OS provider accepts or rejects the offer. If the negotiation has been broken, the OS provider outsources the production work to an OEM.

**Proposition 5. (The decision of vertical outsourcing for open-source operating system provider)**
The OS provider should delegate the hardware maker with less product competitiveness to make its own brand of smartphone if outsourcing to either of the hardware makers can be better off. Formally, when $\min \{ p_{g,i}, p_{g,j} \} > p_{g,i} - p_{g,j} > p_{g,j}$ if $q_i < q_j$.

Our result shows that the OS provider shouldn’t outsource its production work to the hardware maker dominating the market when its smartphone business can be more profitable by outsourcing the production work to any hardware maker than an OEM. From the analysis of the outsourcing cost per quantity, we find that a hardware maker with relatively weak product competitiveness is willing to charge a lower fee for the manufacturing work than the one with strong product competitiveness. This finding reminds the OS provider of the possible outcome that delegating a big hardware maker to produce its handsets could not gain the highest profit. To ensure the better profitability of the OS provider, an sensible alternative for achieving a low outsourcing cost is to notify the hardware maker that the negotiation could be broken if the manufacturing cost is too high and its major rival will be considered in the next run of negotiation.

**CONCLUSION**

In this study, we consider a supply chain consisting of an open-source OS provider and two hardware makers. Both hardware makers can have their own advertising revenue from in-app ads and share a portion of ad revenue from preload apps specified in the agreement with the OS provider. The OS provider can require more number of preload apps to increase its mobile ad revenue but such a strategy may intensify the competition in the smartphone market due to less production differentiation, which may not always benefit its profit in the end. Moreover, we also examine the decision of making the OS provider’s own brand of smartphones. To leverage the advantage from economies of scale, the OS provider may outsource its production work to a suitable hardware maker. As a result, the relationship between the OS provider and the hardware maker having the production order could be both partners and competitors. By applying a styled Cournot differentiation model, several helpful findings are discovered.

First, the OS provider should reduce the number of reload apps if the demand of advertising market is so high or more firms decide to launch their own brand of handsets. The purpose of preloading less number of apps is to facilitate product differentiation so that it will soften the intensive competition among hardware makers and incentivize them to create more market demand. Second, we prescribe the condition under which the strategy of making the OS provider’s own brand of smartphones will take more advantage than receiving mobile advertising revenue only when market factors such as production cost or market profitability changes. Finally, in the scenario of vertical outsourcing, we find that the OS provider may gain more by contracting with a “relatively weak” hardware maker because the other with strong product competitiveness can manipulate the whole market so that it will charge a higher outsourcing fee.

**ACKNOWLEDGEMENTS**

Jhih-Hua Jhang-Li gratefully acknowledges support from the Ministry of Science and Technology, Taiwan, R.O.C. under Grant no. MOST 104-2410-H-266-003-MY3.

**REFERENCES**

APPENDIX

Proof of Proposition 1

Given \( i = 1, 2 \), solving \( \frac{\partial \pi_j}{\partial q_i} = 0 \) where simultaneously \( q_i^* (\nu) = \frac{(2 - \nu)(a - c + (1 - \nu') \beta) + 20_i - \nu \theta_j}{4 - \nu'^2} \) where \( i \neq j \).

Next, after incorporating \( q_i^* (\nu) \) into (3), we have \( \nu^* = \text{Min} \left\{ 1, \sqrt{1 + \frac{2 \alpha + \theta_1 + \theta_2 - 2c}{\gamma \beta}} \right\} \) by solving \( \frac{\partial \pi_i}{\partial u} = 0 \). Accordingly, we have \( \frac{\partial u}{\partial b} = -\frac{2a + \theta_1 + \theta_2 - 2c}{2\beta \sqrt{g(4g^2 + 2a + 2\beta + 2b + 2\theta_2 - 2c)}} < 0 \) and

\[
\frac{\partial u}{\partial g} = -\frac{2a + 2\beta + \theta_1 + \theta_2 - 2c}{2\beta \sqrt{g(4g^2 + 2a + 2\beta + 2b + 2\theta_2 - 2c)}} < 0.
\]

Proof of Proposition 2

Note that \( \frac{\partial \pi_j}{\partial q_i} = \frac{\partial q_i}{\partial u} = \frac{\partial q_i}{\partial n} \). In a homogenous equilibrium, \( q_i = q_2 = \frac{L - q_j}{c + b} \). Subsequently, after incorporating \( q_i^* (\nu) \) into (3), solving \( \frac{\partial \pi_j}{\partial u} = 0 \) can yield \( u^* \) so that we may straightforwardly have

\[
\frac{\partial \nu^*}{\partial n} = \frac{\sqrt{2\beta \gamma \left( (a + \beta + \hat{\theta} - c)(n - 1) + 4\beta \gamma \right) - \sqrt{2 \left( (a + \beta + \hat{\theta} - c)(n - 1) + 4\beta \gamma \right)^2}}{2\beta \gamma \left( (a + \beta + \hat{\theta} - c)(n - 1) + 2\beta \gamma \right)}.
\]

As a result, it is intuitive to verify \( \frac{\partial \nu^*}{\partial n} < 0 \) from the above equation.

Proof of Proposition 3

\[
\pi_{g,Y} - \pi_{g,N} = \frac{L_1 \cdot L_2}{4(2 - \nu)(\nu + 1)(\nu + 2)},
\]

where

\[
L_1 = (\nu + 2)(\nu(\theta_1 + \theta_2 + 2\nu \beta) - (2 + \nu) \theta_g - (a + \beta - c)(4 - \nu^2) - 4\nu^3 \beta \gamma
\]

\[
L_2 = \nu(\theta_1 + \theta_2) - (2 - \nu)(a + \beta - c) - (2 + \nu) \theta_g - 2\nu \beta \gamma
\]
Note that \( \frac{\partial L_1 \cdot L_2}{\partial \theta_s} > 0 \). Letting \( \partial_1 = 0_2 = 0 \), we can show the following results because \( \nu \left( 4 - 4\nu^2 + 3\nu \right) < 4 \) can be verified in a numerical approach.

\[
L_1 = (\nu^2 - 4) (\theta_s + a + \beta - c) + \nu \left( 4 - 4\nu^2 + 2\nu \right) \beta \gamma \\
= (\nu^2 - 4) (\theta_s + a - c) + (\nu^2 - 4) \beta + \nu \left( 4 - 4\nu^2 + 2\nu \right) \beta \gamma \\
\leq (\nu^2 - 4) (\theta_s + a - c) + (\nu (4 - 4\nu^2 + 3\nu) - 4) \beta \\
\leq (\nu^2 - 4) (\theta_s + a - c) < 0 \\
L_2 = -(2 - \nu) (\theta_s + a + \beta - c) - 2\nu \beta \gamma < 0
\]

**Proof of Proposition 4**

\[
(1) \quad \frac{\partial \pi_{g_i}}{\partial \gamma} = \frac{\partial \pi_{g_{i,N}}}{\partial \gamma} = -4\nu^2\beta \left( (2\nu(1-2\nu) + 4) \beta \gamma + \nu (\theta_i + \theta_2 - \theta_s) - (2 - \nu) \nu (a + \beta - c) \right)
\]

Therefore,

\[
\frac{\partial \pi_{g_i}}{\partial \gamma} < \frac{\partial \pi_{g_{i,N}}}{\partial \gamma} \quad \text{when} \quad a < \frac{(2\nu(1-2\nu) + 4) \beta \gamma + \nu (\theta_i + \theta_2 - \theta_s) - (2 - \nu) \nu (a + \beta - c)}{2 - \nu} - \beta + c
\]

\[
(2) \quad \pi_{g_i} - \pi_{g_{i,N}} = \frac{L_1 \cdot L_2}{4(2 - \nu)^2 (\nu + 1) (\nu + 2)}
\]

\[
\frac{\partial L_1 \cdot L_2}{\partial a} = -\frac{\partial L_1 \cdot L_2}{\partial c} = 2(2 - \nu) \left( 2\nu^2 \beta \gamma + 4(a + \beta - c + \theta_s) - \nu^2 (a + \beta - c + \theta_i + \theta_2 - \theta_s) - 2\nu (\theta_i + \theta_2 - \theta_s) \right)
\]

Therefore,

\[
\frac{\partial \pi_{g_i}}{\partial a} > \frac{\partial \pi_{g_{i,N}}}{\partial a} \quad \text{when} \quad \theta_i \approx \theta_2 \approx \theta_s \quad \text{because} \quad \frac{\partial L_1 \cdot L_2}{\partial a} \approx 2(2 - \nu) \left( 2\nu^2 \beta \gamma + (4 - \nu^2)(a + \beta - c + \theta_s) \right) > 0
\]

**Proof of Proposition 5**

\[
p_{g_i} = (q_{g,i} + 2bg)q_{g,s} + b \frac{\theta_i - 2\theta_s - 2bg + 2a\nu_i - 2c + e}{2 - u}
\]

, where \( q_{g,i} = \frac{(a + \beta)(2 - u) + (2 + u)(\theta_s - w_i) - u(\theta_i + \theta_j - 2c + \epsilon) + 2u\beta g}{2(2 - u)(1 + u)} \). Note that \( p_{g,i} > 0 \); in addition,

\[
(q_{g,i} + 2bg)q_{g,i} \quad \text{is a quadratic function of} \quad w_i \quad \text{and} \quad b = \frac{\theta_i - 2\theta_s - 2bg + 2a\nu_i - 2c + e}{2 - u} \quad \text{is an increasing function of} \quad w_i \quad \text{. Therefore, solving} \quad p_{g,i} = p_{g,i} \quad \text{yields two roots} \quad \text{when} \quad \text{the root of} \quad w_i^* \quad \text{is the smaller one,} \quad q_{g,i} > 0 \quad \text{and} \quad q_{g,i}^* < 0 \quad \text{when} \quad \text{the root of} \quad w_i^* \quad \text{is the larger one. Therefore, we consider the case in which the interior solution of} \quad w_i \quad \text{is the smaller one for} \quad p_{g,i} = p_{g,i} \quad \text{; otherwise, only the boundary solution exists. Note that the formulations of} \quad p_{g,i} \quad \text{and} \quad p_{g,i}^* \quad \text{are the same other than} \quad w_i \quad \text{and} \quad w_i^* \quad \text{; thus, we aim to find the smallest outsourcing fee, which enables the OS provider to gain more. Solving} \quad p_{g,i} = p_{g,i} \quad \text{, we have}
\]

\[
2(2 + u - 2u^2)\theta_i + u^3(q_{g,i} - bg) + ((u^2 + u)(4 - 3u) + (4 + 2u))(c - e)
\]

\[
= \frac{8 + 8u - 2u^3 - 3u^2}{8 + 8u - 2u^3 - 3u^2}
\]

W.L.O.G., we assume \( \theta_2 > \theta_1 \). As a result, the following inequalities complete the proof.
\[ w_1^* < w_2^* \quad \Rightarrow \quad u^2 q_1 \cdot u \theta_2 (2 + 2u - u^2) < u^2 q_2 - u \theta_1 (2 + 2u - u^2) \]

\[ \Rightarrow \quad u^2 q_1 \cdot \theta_1 (2 + 2u - u^2) < u^2 q_2 - \theta_1 (2 + 2u - u^2) \]

\[ \Rightarrow \quad - \theta_2 (2 + 2u) < - \theta_1 (2 + 2u) \]

\[ \Rightarrow \quad \theta_2 > \theta_1 \]
AN ASSESSMENT MODEL FOR INFORMATION SYSTEM’S RISK BASED ON ENTROPY METHOD AND GREY THEORY

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ABSTRACT

In the process of risk assessment of information system, the risk assessment method and model are the key point. This paper analyzes the risk assessment methods of the information system, and points out the limitations of some methods. Considering the grey and dynamic characteristics of the evaluation index, the evaluation model based on Entropy Method and Grey Theory is presented, and the validity of the method is demonstrated by an example.

Keyword: Information system’s risk; grey class; whitenization weight function ; risk level

INTRODUCTION

Methods for risk assessment of information system play an important role. From the analysis of the assets, threats, vulnerabilities and security measures we can use some methods to evaluate the risk level of the information system and a scientific and effective risk assessment report is generated [3].

There are many methods of risk assessment, which can be divided into three categories: quantitative risk assessment method, qualitative risk assessment method, qualitative and quantitative assessment method. The qualitative method mainly focus on knowledge, experience, lessons of history and policy direction and special cases such as non-quantitative data [6]. It is based on in-depth interviews with the respondents to make a case record, and then through a theoretical derivation of the analytical framework of the interpretation of the data for encoding, at last the conclusion of the investigation about the level of information system risk is generated [2]. The typical method of qualitative analysis with factor analysis method, logical analysis, historical comparative method, Delphi method and so on [4]. Quantitative assessment is to assess the risk of information system using the quantitative indicators. The advantage of quantitative assessment method is to describe the results of the assessment using intuitive data, and the result is more clear and objective. Sometimes the quantitative analysis methods can make the research result more scientific, more rigorous and more profound [9]. For example a data is able to explain the problem that can not be explained clearly with a large section of the text. But it is very difficult to quantify risk assessment of information system. Firstly it is difficult to choose the grain size to quantitative assessment. Secondly attack source is widely distribute with all sorts of motives. It is impossible to predict the probability and frequency of security incidents. Information system is constantly updated and improved, the risk factors have continued to change, the previously acquired data is not adapted to the new situation, the data need to continue to change.

sometimes the complex things become too simple and fuzzy in order to quantify, and even too simple to represent things in themselves. Some quantified risk factors may be misunderstood and distorted. The advantage of qualitative assessment method is to avoid the shortcomings of the quantitative method, and it can dig out some deep thinking, which makes the evaluation more comprehensive and operational, but it is very subjective, so it needs the evaluators with highly professional knowledge and rich experience in the field of information system evaluation [7].

In the early days when research on information system risk assessment method, has just been put out, domestic and foreign scholars mainly study for risk assessment of information system from the qualitative point of view ,and mainly focuses some non system risk, such as personnel risk, management risk, environmental risk and so on. Then some scholars introduced the quantitative model to the information system risk assessment. At this time, the focus of the study is the systematic risk of the information system. There are two types of models, one is statistical model, such as mathematical programming. Bias model, clustering analysis and so on [8]. The greatest strength of the statistical model is that it has a clear explanation. But it has obvious defects which is too strict prerequisite. Attack source is widely distributed with all sorts of motives. It is impossible to identify and calculate the probability distribution of security incidents. The loss and potential impact of security incident is difficult to accurately estimate. In general statistical model needs large sample data. But the data of information system security is difficult to achieve. The other is artificial intelligence model, such as neural network, expert system, classification tree, etc.. The arrangement of every input weight is very important using the neural network technology. Information system is constantly updated and improved, the risk factors have continued to change, the previously acquired data is not adapted to the new situation, the data is real-time and dynamic. So the generalization ability of training sample is poor. Because of the complexity and dynamic of the information system, it is difficult to grasp the suitable assignment of initial weight. In addition, neural network technique is easy to form local optimum and can not get the whole optimum [1]. There is also a big limitation that it is difficult to find the training sample [5]. In view of the influence factors of information system, most of the indicators are dynamic and grey. The data of information system security is difficult to achieve. The grey system theory , established by Julong Deng in 1982., is a new methodology that focuses on the study of problems involving small sample and poor
information. It deals with uncertain system with partial known information through generating, excavating, and extracting useful information from what is available, so that systems operational behaviors and their laws of evolution can be correctly described and effectively monitored. So the grey evaluation theory is suitable to evaluate the risk of information system. This model based on grey theory can overcome some defects of statistical model and neural network model. Firstly the Grey system theory can study on small sample and poor data. In the whole process of risk assessment ,at present we only achieve some objective and quantitative data by intrusion detection ,system audit, vulnerability scanning technology and so on. Secondly the grey system theory focus on the laws of evolution and can analysis the information real-time risk. It is important that the grey system can solve the problem of neural network that under the dynamic data the generalization ability of training sample of neural network is poor.

**ASSESSMENT MODEL OF INFORMATION SYSTEMS RISK BASED ON ENTROPY METHOD AND GREY THEORY**

**Index System for Risk Assessment of Information System**

It is the prerequisite to evaluate the risk of information system that the risk factors is correctly analyzed and the suitable assessment index system is established [10]. Learning from the foreign BS7799 information security standards system and considering the actual situation of our country’s information system security, index system for risk assessment of information system is generated as table 1.

### Table 1. Evaluation Index System of Information System’ Risk

<table>
<thead>
<tr>
<th>Target layer</th>
<th>Criterion layer</th>
<th>Index layer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Threat level, (X₁)</td>
<td>Management security (X₂₁)</td>
<td>The risk of information’s removing and stealing, (X₁₁)</td>
</tr>
<tr>
<td></td>
<td>Physical device security, (X₂₂)</td>
<td>The risk of network resource’s destroying, (X₁₂)</td>
</tr>
<tr>
<td></td>
<td>Software security, (X₂₃)</td>
<td>The risk of information’s abusing and tampering, (X₁₃)</td>
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<tr>
<td></td>
<td>Hardware security (X₂₄)</td>
<td>The risk of Service disruption and prohibition, (X₁₄)</td>
</tr>
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<td></td>
<td>Personnel security, (X₂₅)</td>
<td>The risk of Information leakage, (X₁₅)</td>
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<tr>
<td></td>
<td>Environment security, (X₂₆)</td>
<td>The risk of fake access, (X₁₆)</td>
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<tr>
<td></td>
<td>Communication security, (X₂₇)</td>
<td>The risk of bypass control, (X₁₇)</td>
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<tr>
<td></td>
<td>Protective measure, (X₃)</td>
<td>The risk of authorization violation, (X₁₈)</td>
</tr>
<tr>
<td>Vulnerability level, (X₂)</td>
<td>Recovery technique measures, (X₃₁)</td>
<td>The risk of service degradation, (X₁₉)</td>
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<td></td>
<td>Encryption measures, (X₃₂)</td>
<td>Information recovery cost, (X₁₇)</td>
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<td></td>
<td>Anti hacking measures, (X₃₃)</td>
<td>Service recovery cost (X₁₈)</td>
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<td>Anti virus measures, (X₃₄)</td>
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<td>Data backup measures, (X₃₅)</td>
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<tr>
<td>Consequence severity, (X₄)</td>
<td>The severity of environmental degradation, (X₁₄)</td>
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<td></td>
<td>The severity of service degradation (X₁₂)</td>
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<td></td>
<td>Information recovery cost, (X₁₃)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Service recovery cost (X₁₄)</td>
<td></td>
</tr>
</tbody>
</table>
Measure the Weight of Each Indicator with Entropy Method

(1) According to the polarity of each indicator, standardize all index data of information systems risk. For the positive indicator data, use formula (1) to standardize; and for the negative index data, use formula (2) to standardize.

\[ X'_{ij} = \frac{x_{ij} - \min(x_{ij})}{\max(x_{ij}) - \min(x_{ij})} \] (1)

\[ X'_{ij} = \frac{\max(x_{ij}) - x_{ij}}{\max(x_{ij}) - \min(x_{ij})} \] (2)

(2) Calculate the index information entropy by the formula (3)

\[ h_j = -k \sum_{i=1}^{m} \{ (X'_{ij} \cdot \sum_{i=1}^{m} X'_{ij}) \cdot \ln(X'_{ij} / \sum_{i=1}^{m} X'_{ij}) \} \] (3)

In formula (3), \( k = \ln m \) ; and the index information entropy \( h_j = 0 \), if the value of index data standardization \( X'_{ij} = 0 \).

(3) Calculate the redundancy of each index’s information entropy by the formula

\[ d_j = 1 - h_j \] (4)

(4) Use the redundancy of information entropy to calculate the index weight through the formula

\[ \eta_j = d_j \sum_{j=1}^{n} d_j \] (5)

Evaluation of Grey Class

Due to the limitation of the expert level and the difference in the cognition angle, only a few of whiten weight of grey numbers are given. In order to truly reflect the level of a certain class, it is necessary to determine the evaluation of grey class.

In this setting, it is supposed that the whitenization weight function is the triangle whitenization weight function ,and there are five levels in grey class, the grey grades \( h = 1, 2, 3, 4, 5 \). Respectively, It is very low, low, medium, high,, very high. It is supposed that the grey number of every grey class is \( \Theta_h \in [0, 2h] \). The whitenization weight function is \( f_h \)

\[ f_h(d_{ijk}) = \begin{cases} \frac{d_{ijk}}{h} & d_{ijk} \in [0, h] \\ \frac{2h-d_{ijk}}{2h-h} & d_{ijk} \in [h, 2h] \\ 0 & \text{else} \end{cases} \] (6)

Grey Evaluation Weight Vector and Weight Matrix

The grey class of belongingness of The index \( x_{ij} \) denote \( M_{ijk} \), and \( M_{ijk} \) is defined as \( M_{ijk} = \sum_{k=1}^{m} f_k(d_{ijk}) \), and

\[ M_{ij} = \sum_{k=1}^{s} M_{ijk}, \text{then the belongingness of } x_{ij} \text{ in the grey class } h \text{ for } m \text{ experts is } q_{ijh}, \]

\[ q_{ijk} = \frac{M_{ijk}}{M_{ij}} \] (7)

There are 5 grey classes , and \( h=1,2,3,4,5 \), the grey class of belongingness of \( x_{ij} \) in \( h \) is the grey evaluation weight vector \( q_{ij} = (q_{i1}, q_{i2}, q_{i3}, q_{i4}, q_{i5}) \). Then a grey evaluation weight matrix is generated \( Q \).

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After the comprehensive evaluation of the second-level indexes, the grey evaluation weight vector $B_i$ of $X$'s comprehensive evaluation is obtained.

$$B_i = w_i \times Q_i = (b_{i1}, b_{i2}, b_{i3}, b_{i4}, b_{i5})$$

Then all the grades of belongingness of $x_i$ in the grey degree $h$ produce the grey evaluation weight matrix $Q$. Where $Q = [B_1, B_2, B_3, B_4, B_5]^T$.

After the first-level indexes are evaluated comprehensively, the result of the evaluation produce the value of comprehensive assessment

$$B = w \times Q = (b_1, b_2, b_3, b_4, b_5)$$

Assign values to the grey degree and produce the evaluation of grey level vector $C = (1, 2, 3, 4, 5)$

$$V_{Bi} = B_i \times C^T$$

$$V_B = B \times C^T$$

Here in the Formula (11) $V_{Bi}$ denote the level of the impact factors, and in the Formula (12) $V_B$ denote the level value of the risk value of the information system. So we can take appropriate measures to carry out risk control and risk aversion according to the risk state of the factors.

**EMPIRICAL ANALYSIS**

Five hospitals in Fujian province are selected — Fujian Medical University Union Hospital (Unit 1), Fujian Provincial Hospital (Unit 2), The First Affiliated Hospital of Fujian Medical University (Unit 3), The Second Affiliated Hospital of Fujian Medical University (Unit 4), Nanjing General Hospital of Nanjing Military Command (Unit 5) to exemplify the validity of the Entropy Method and Grey Theory in the risk assessment. As the chart shows, there are four criterion layer indexes, and 24 index layer indicators.

**Collect and Standardize Data**

Quantitative indicators data in Table 1 are acquired from hospital information system statistical data, and qualitative data comes out from experts. After Standardization the index data of five units is as the following in Table 2.

<table>
<thead>
<tr>
<th>Index</th>
<th>Unit1</th>
<th>Unit2</th>
<th>Unit3</th>
<th>Unit4</th>
<th>Unit5</th>
</tr>
</thead>
<tbody>
<tr>
<td>X11</td>
<td>0.423</td>
<td>0.124</td>
<td>0.311</td>
<td>0.243</td>
<td>0.215</td>
</tr>
<tr>
<td>X12</td>
<td>0.441</td>
<td>0.315</td>
<td>0.324</td>
<td>0.223</td>
<td>0.207</td>
</tr>
<tr>
<td>X13</td>
<td>0.343</td>
<td>0.278</td>
<td>0.347</td>
<td>0.197</td>
<td>0.223</td>
</tr>
<tr>
<td>X14</td>
<td>0.522</td>
<td>0.314</td>
<td>0.351</td>
<td>0.215</td>
<td>0.264</td>
</tr>
<tr>
<td>X15</td>
<td>0.425</td>
<td>0.417</td>
<td>0.462</td>
<td>0.518</td>
<td>0.178</td>
</tr>
<tr>
<td>X16</td>
<td>0.467</td>
<td>0.378</td>
<td>0.356</td>
<td>0.419</td>
<td>0.224</td>
</tr>
<tr>
<td>X17</td>
<td>0.433</td>
<td>0.436</td>
<td>0.427</td>
<td>0.461</td>
<td>0.215</td>
</tr>
<tr>
<td>X18</td>
<td>0.387</td>
<td>0.315</td>
<td>0.439</td>
<td>0.368</td>
<td>0.308</td>
</tr>
<tr>
<td>X19</td>
<td>0.455</td>
<td>0.418</td>
<td>0.399</td>
<td>0.378</td>
<td>0.267</td>
</tr>
<tr>
<td>X20</td>
<td>0.418</td>
<td>0.532</td>
<td>0.415</td>
<td>0.524</td>
<td>0.312</td>
</tr>
<tr>
<td>X21</td>
<td>0.437</td>
<td>0.357</td>
<td>0.423</td>
<td>0.451</td>
<td>0.311</td>
</tr>
</tbody>
</table>
The Fifteen International Conference on Electronic Business, Hong Kong, December 6-10, 2015

| X_{24} | 0.323 | 0.437 | 0.478 | 0.403 | 0.204 |
| X_{25} | 0.354 | 0.423 | 0.404 | 0.375 | 0.211 |
| X_{26} | 0.375 | 0.422 | 0.415 | 0.378 | 0.279 |
| X_{27} | 0.314 | 0.475 | 0.317 | 0.455 | 0.246 |
| X_{31} | 0.415 | 0.426 | 0.387 | 0.398 | 0.231 |
| X_{32} | 0.378 | 0.418 | 0.437 | 0.356 | 0.319 |
| X_{33} | 0.425 | 0.417 | 0.481 | 0.427 | 0.306 |
| X_{34} | 0.472 | 0.456 | 0.392 | 0.375 | 0.278 |
| X_{35} | 0.423 | 0.408 | 0.414 | 0.428 | 0.139 |
| X_{41} | 0.437 | 0.397 | 0.367 | 0.354 | 0.231 |
| X_{42} | 0.465 | 0.437 | 0.412 | 0.427 | 0.271 |
| X_{43} | 0.396 | 0.378 | 0.318 | 0.354 | 0.197 |
| X_{44} | 0.456 | 0.471 | 0.428 | 0.369 | 0.234 |

Calculate Weight of the Evaluation Index

Use entropy method to calculate weight of information’s evaluation index, as is shown in Table 3.

Table 3. Entropy and Weight of Evaluation Index

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Index</th>
<th>Entropy $h_j$</th>
<th>Redundancy $d_j$</th>
<th>Levels weight $\eta_j$</th>
<th>Combined weight $\eta'_j$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$X_1$</td>
<td>$X_{11}$</td>
<td>0.729</td>
<td>0.271</td>
<td>0.137</td>
<td>0.035</td>
</tr>
<tr>
<td></td>
<td>$X_{12}$</td>
<td>0.676</td>
<td>0.324</td>
<td>0.103</td>
<td>0.026</td>
</tr>
<tr>
<td></td>
<td>$X_{13}$</td>
<td>0.792</td>
<td>0.208</td>
<td>0.160</td>
<td>0.042</td>
</tr>
<tr>
<td></td>
<td>$X_{14}$</td>
<td>0.767</td>
<td>0.233</td>
<td>0.132</td>
<td>0.032</td>
</tr>
<tr>
<td></td>
<td>$X_{15}$</td>
<td>0.654</td>
<td>0.346</td>
<td>0.09</td>
<td>0.021</td>
</tr>
<tr>
<td></td>
<td>$X_{16}$</td>
<td>0.763</td>
<td>0.237</td>
<td>0.113</td>
<td>0.026</td>
</tr>
<tr>
<td></td>
<td>$X_{17}$</td>
<td>0.812</td>
<td>0.188</td>
<td>0.145</td>
<td>0.031</td>
</tr>
<tr>
<td></td>
<td>$X_{18}$</td>
<td>0.673</td>
<td>0.337</td>
<td>0.12</td>
<td>0.023</td>
</tr>
<tr>
<td>$X_2$</td>
<td>$X_{21}$</td>
<td>0.791</td>
<td>0.209</td>
<td>0.129</td>
<td>0.023</td>
</tr>
<tr>
<td></td>
<td>$X_{22}$</td>
<td>0.784</td>
<td>0.216</td>
<td>0.24</td>
<td>0.024</td>
</tr>
<tr>
<td></td>
<td>$X_{23}$</td>
<td>0.79</td>
<td>0.21</td>
<td>0.131</td>
<td>0.036</td>
</tr>
<tr>
<td></td>
<td>$X_{24}$</td>
<td>0.812</td>
<td>0.188</td>
<td>0.114</td>
<td>0.031</td>
</tr>
<tr>
<td></td>
<td>$X_{25}$</td>
<td>0.736</td>
<td>0.264</td>
<td>0.107</td>
<td>0.022</td>
</tr>
<tr>
<td></td>
<td>$X_{26}$</td>
<td>0.765</td>
<td>0.235</td>
<td>0.117</td>
<td>0.024</td>
</tr>
<tr>
<td></td>
<td>$X_{27}$</td>
<td>0.853</td>
<td>0.147</td>
<td>0.162</td>
<td>0.027</td>
</tr>
<tr>
<td>$X_3$</td>
<td>$X_{31}$</td>
<td>0.713</td>
<td>0.287</td>
<td>0.163</td>
<td>0.035</td>
</tr>
<tr>
<td></td>
<td>$X_{32}$</td>
<td>0.769</td>
<td>0.231</td>
<td>0.212</td>
<td>0.037</td>
</tr>
<tr>
<td></td>
<td>$X_{33}$</td>
<td>0.661</td>
<td>0.339</td>
<td>0.311</td>
<td>0.039</td>
</tr>
<tr>
<td></td>
<td>$X_{34}$</td>
<td>0.767</td>
<td>0.233</td>
<td>0.114</td>
<td>0.038</td>
</tr>
<tr>
<td></td>
<td>$X_{35}$</td>
<td>0.734</td>
<td>0.266</td>
<td>0.20</td>
<td>0.022</td>
</tr>
<tr>
<td>$X_4$</td>
<td>$X_{41}$</td>
<td>0.459</td>
<td>0.541</td>
<td>0.216</td>
<td>0.311</td>
</tr>
<tr>
<td></td>
<td>$X_{42}$</td>
<td>0.761</td>
<td>0.239</td>
<td>0.314</td>
<td>0.029</td>
</tr>
<tr>
<td></td>
<td>$X_{43}$</td>
<td>0.729</td>
<td>0.271</td>
<td>0.268</td>
<td>0.025</td>
</tr>
<tr>
<td></td>
<td>$X_{44}$</td>
<td>0.75</td>
<td>0.25</td>
<td>0.202</td>
<td>0.041</td>
</tr>
</tbody>
</table>
Calculate Whiten Weight Matrix

\[
Q = \begin{bmatrix}
0 & 0.293 & 0.894 & 0.576 & 0.329 \\
0 & 0.544 & 0.677 & 0.783 & 0.219 \\
0 & 0.634 & 0.522 & 0.617 & 0.322 \\
0 & 0.542 & 0.486 & 0.723 & 0.355 \\
0 & 0.615 & 0.712 & 0.521 & 0.423 \\
0 & 0.772 & 0.624 & 0.822 & 0.543 \\
0 & 0.612 & 0.542 & 0.754 & 0.566 \\
0 & 0.237 & 0.576 & 0.433 & 0.321 \\
\end{bmatrix}
\]

Then use the formula \( Q = (B_i) = (W_i ? Q_i) \) to calculate the comprehensive evaluation value of the five hospitals' information system risk, as the following Table 4.

<table>
<thead>
<tr>
<th>Unit</th>
<th>( B_i )</th>
<th>( (B_i) = (W_i ? Q_i) )</th>
<th>( V_{B_i} )</th>
<th>( V_B )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit 1</td>
<td>( B_1 )</td>
<td>(0.214 0.673 0.552 0.417 0.369)</td>
<td>0.325</td>
<td></td>
</tr>
<tr>
<td></td>
<td>( B_2 )</td>
<td>(0.324 0.433 0.615 0.756 0.519)</td>
<td>0.416</td>
<td>0.453</td>
</tr>
<tr>
<td></td>
<td>( B_3 )</td>
<td>(0.214 0.513 0.175 0.456 0.473)</td>
<td>0.334</td>
<td></td>
</tr>
<tr>
<td></td>
<td>( B_4 )</td>
<td>(0.423 0.215 0.765 0.522 0.774)</td>
<td>0.563</td>
<td></td>
</tr>
<tr>
<td>Unit 2</td>
<td>( B_1 )</td>
<td>(0.334 0.231 0.167 0.655 0.528)</td>
<td>0.342</td>
<td></td>
</tr>
<tr>
<td></td>
<td>( B_2 )</td>
<td>(0.224 0.261 0.187 0.644 0.788)</td>
<td>0.516</td>
<td>0.447</td>
</tr>
<tr>
<td></td>
<td>( B_3 )</td>
<td>(0.122 0.235 0.324 0.415 0.678)</td>
<td>0.433</td>
<td></td>
</tr>
<tr>
<td></td>
<td>( B_4 )</td>
<td>(0.512 0.245 0.414 0.375 0.376)</td>
<td>0.313</td>
<td></td>
</tr>
<tr>
<td>Unit 3</td>
<td>( B_1 )</td>
<td>(0.612 0.345 0.517 0.355 0.361)</td>
<td>0.417</td>
<td></td>
</tr>
<tr>
<td></td>
<td>( B_2 )</td>
<td>(0.432 0.645 0.557 0.335 0.343)</td>
<td>0.438</td>
<td>0.412</td>
</tr>
<tr>
<td></td>
<td>( B_3 )</td>
<td>(0.212 0.345 0.257 0.675 0.423)</td>
<td>0.347</td>
<td></td>
</tr>
<tr>
<td></td>
<td>( B_4 )</td>
<td>(0.513 0.415 0.237 0.475 0.313)</td>
<td>0.322</td>
<td></td>
</tr>
<tr>
<td>Unit 4</td>
<td>( B_1 )</td>
<td>(0.323 0.455 0.264 0.325 0.412)</td>
<td>0.357</td>
<td></td>
</tr>
<tr>
<td></td>
<td>( B_2 )</td>
<td>(0.533 0.511 0.474 0.625 0.318)</td>
<td>0.461</td>
<td>0.437</td>
</tr>
<tr>
<td></td>
<td>( B_3 )</td>
<td>(0.431 0.511 0.374 0.425 0.312)</td>
<td>0.442</td>
<td></td>
</tr>
<tr>
<td></td>
<td>( B_4 )</td>
<td>(0.621 0.413 0.214 0.315 0.416)</td>
<td>0.415</td>
<td></td>
</tr>
<tr>
<td>Unit 5</td>
<td>( B_1 )</td>
<td>(0.301 0.313 0.374 0.285 0.316)</td>
<td>0.356</td>
<td></td>
</tr>
<tr>
<td></td>
<td>( B_2 )</td>
<td>(0.431 0.323 0.404 0.385 0.226)</td>
<td>0.378</td>
<td>0.305</td>
</tr>
<tr>
<td></td>
<td>( B_3 )</td>
<td>(0.121 0.123 0.04 0.685 0.126)</td>
<td>0.218</td>
<td></td>
</tr>
<tr>
<td></td>
<td>( B_4 )</td>
<td>(0.201 0.173 0.154 0.285 0.226)</td>
<td>0.203</td>
<td></td>
</tr>
</tbody>
</table>

From the Table, we can see that the five hospital information system are in the medium risk. The first-level indexes: threatening factors, vulnerability factors, protective measures and the consequences severity are in the state of a certain degree of risk. In the five hospital information system, we can see the index: protection measure is in higher risk than other three first-level indexes. Nanjing General Hospital of Nanjing Military Command(Unit 3)'s risk is lower than the other four hospital. This may be attributed to the attention of confidentiality for the military hospital. Fujian Medical University Union Hospital(Unit 1)'s risk is the highest.
especially in the consequences severity the score is 0.563. It maybe is a cause that there is the biggest infectious ward. The protection measures must be strengthened , or the information service security will become a hidden danger. the impact on Fujian Medical University Union Hospital is very large, leading to the deterioration of services, resulting in huge recovery costs. It is recommended that the hospital improve the installation of information security equipment and conduct regular checks and updates, such as firewall, access log, intrusion detection system, weak point scanner and so on.

CONCLUSIONS

The evaluation of information system risk is a systematic assessment problem with multi-index, multi-level and the index is grey and dynamic .To solve the problem, this paper presented a assessment method based Entropy Method and Grey Theory. The empirical study of five hospital indicated that it was effective to use the method to systematically evaluate information system risk and its evaluation result was comparatively objective and accurate.

REFERENCE


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AN EXTENDED MODEL OF REVIEW HELPFULNESS: EXPLORING THE ROLE OF TIE STRENGTH, PERCEIVED SIMILARITY, AND NORMATIVE SUSCEPTIBILITY*

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ABSTRACT

Previous studies on review information evaluation focus on the important roles of two key factors namely argument strength and source credibility but pay less attention to how social influence and social relationship exert impact on this information evaluation behavior. To fill this research gap, based on the similarity – attraction theory and social capital theory, we articulate how source credibility is determined by two social relationship factors: tie strength and perceived similarity. Further, drawing upon the social influence model, we propose that the susceptibility to normative influence intensifies the impact exerted on source credibility by tie strength and perceived similarity. Also, relationships between argument strength and review helpfulness and between source credibility and review helpfulness are both moderated by normative susceptibility. A survey is conducted to test the proposed research model and the results suggest that hypotheses are supported. The results offer important and interesting insights to information systems research and practice.

Keywords: eWOM, normative susceptibility, dual process theory, social capital theory, similarity-attraction theory

INTRODUCTION

The advancement of network technology has encouraged the proliferation of eWOM reviews. Electronic Word-Of-Mouth (eWOM), originally developed in the web context where it provides online consumers a platform to share their shopping experience through online communication [29][57], has recently attracted researchers’ attention. Formed from online reviews, eWOM plays a significant role in individuals’ decision making. According to the prior eWOM literature, some researchers suggested that eWOM is likely to result in more time to consider the recommended product [29]. Research has also shown eWOM exerts a strong influence on the purchase decisions of consumers [23][51] and on the sales of products in different categories (e.g., books, movies, and hotel rooms) [64]. Thus, this topic about eWOM has attracted researchers’ attention.

For example, some researchers have posed questions as to how users evaluate the indirect experience information, how they can easily and quickly find the helpful information, and how those websites recommend or position reviews according to helpfulness[65]. Others [61] find that potential customers are more receptive to those reviews that are perceived more helpful, and thus that more helpful, reviews have stronger influence on users’ purchasing decisions. As the perception of review helpfulness reflects a user’s information evaluation, research shows that the dual process theory of external information process is an appropriate theoretical foundation for online review studies[65]. Among the dual process researches, heuristic-systematic model (HSM) appears to be valid perspectives in explaining the impacts of eWOM on online consumers [11][23]. For example, Chen (2014) applied HSM to explain individuals’ healthy decision-making process. Besides, [60] developed a research model to identify the factors that are important to consumers' purchase processing by using HSM.

Since eWOM raised from a possibly unlimited number of unknown participants in online contexts, most reviews were contributed from strangers on the Internet [59]. However, nowadays some of the websites, such as Dianping (www.dianping.com) from China, try to integrate the eWOM services with the social networking services. It means people can gain online friends easily and build relationships with others. Thus, online reviews can come from online friends with social relationships established in networks[59]. From this perspective, it’s interesting to investigate how social influence factors such as social relationship in eWOM contexts and susceptibility to social influence of online reviewers can affect the function of eWOM on consumers. Although previous studies drawing upon dual process theories have highlighted that argument strength and source credibility play important roles in the information adoption process, research examining how social relationships and social influence affect online eWOM users is still limited.

In this study, we intend to fill the research gap by capturing the social networking features as well as the individual personalities relevant to social influence. Based on the dual process theories, argument strength and source credibility are included as the pivotal constructs in the research model. Further, we propose two social relationship factors (i.e., tie strength and perceived similarity) as the antecedents of source credibility of online eWOM reviews and users’ personality namely the susceptibility to normative influence as the moderator that define the strengths of the relationships between argument strength and review helpfulness, between source credibility and review helpfulness, and the effect the two antecedents exerting on source credibility are also moderated by recipient’s susceptibility to normative influence.

*The fifteenth International Conference on Electronic Business, Hong Kong, December 6-10, 2015
THEORETICAL BACKGROUND

Dual Process Theory and Heuristic-Systematic Model

Dual process theories provide comprehensive discussions on how individuals process information, establish its validity assessments, and later form decision outcomes[20]. Many models of dual process theories have been applied to explain how people are influenced by received information, and in current literature of dual-process theories, two of the most prevalent models are the elaboration likelihood model (ELM) [50] and the heuristic-systematic model (HSM)[5]. These two models use similar underlying mechanisms to explain the information processing. Both of the central route in the ELM and the systematic processing in the HSM indicate that individuals use high cognitive effort to elaborate information; while the peripheral route in the ELM and the heuristic processing in the HSM suggest individuals adopt heuristics and simple decision rules to quickly form judgments. In this study, we choose HSM rather than ELM to examine individuals’ information processing in eWOM contexts.

Heuristic-systematic model examines the influence of both the information content of a received message and factors in the surrounding context [63]. It is theorized to explain broader information processing activities[7], which differentiate systematic processing from heuristic processing. Applied to persuasion, systematic processing implies that people form or update their attitudes by actively attending to and cognitively elaborating persuasive argumentation[8]. In contrast, heuristic processing specifies that the information recipients spend little effort and rely on accessible cues to gain conclusions[7]. According to the current study, Ferran and Watts[22] used the HSM and highlighted its capability in explaining a wider range of validity-seeking contexts. Zhang and Watts (2008) demonstrated argument quality (systematic processing) and source credibility (heuristic processing) can affect the adoption of online reviews in online communities.

When both systematic and heuristic processing are met, HSM holds that both processing modes can occur simultaneously. According to researches, these co-occurrence of processing modes can be described through three theoretical extensions, namely the additivity, attenuation, and bias effect [8][60]. The bias effect indicates that heuristic processing may alter recipients' judgment indirectly through biasing systematic processing[8]. For example, Zhang et al. (2014) used bias effect of HSM to elucidates the interrelationship between heuristic and systematic factors.

Since there are many non-content related cues in online eWOM contexts (e.g., characteristics of information sources), researchers tend to distinguish whether a certain heuristic cue is valid or not; and HSM processing modes also have highlighted the co-occurrence of systematic and heuristic information processing. Thus it is better to apply HSM in the online eWOM contexts than other models from dual process theories. In this study, we attempt to use the heuristic-systematic model to understand the impacts of online consumer reviews.

Social Capital Theory

Social capital theory is concerned with the significance of social relationships as a source of social action [17] as well as value creation[46]. Social capital is defined as “the sum of the actual and potential resources embedded within, and derived from the network of relationships possessed by an individual or social unit” ([46]. It is applied to describe the relational resources deeply rooted in the ongoing relationships between actors within a certain social network which facilitates the various social interactions between them[17].

Social capital is generally considered to involve three dimensions: structural, cognitive, and relational[46]. Structural capital is “the overall pattern of connections between actors—that is, who you reach and how you reach them” ([46], p. 244). Structural capital is generated by the structure of a social network and the interactions among actors, including the location of actors and the frequency of communication. It describes the “impersonal configuration of links between people or units” ([46], p. 244). And cognitive capital is defined as those resources that enable shared interpretations and representations among parties [16]. It emphasizes the common understanding which facilitates interactions among actors in the social network. Finally, relational capital involves assets created and leveraged through social relationships, including trust, trustworthiness, norms, identification, and obligations[46]. These three dimensions of social capital are interrelated such that cognitive and relational capital are regarded to be built on the basis of structural capital[58].

Similarity-Attraction Theory

The similarity attraction theory was first established in the psychological area [34], and it suggests that people like and are appealed to others who are similar, rather than dissimilar to themselves [4]. The most suitable explanation for these similarity effects is rewards-of-interacting [21]. In other words, interacting with similar others validates people’s views and justifies that they are correct in their thinking. It suggests that people are attracted to those who give them chances to enhance themselves [54].

Based on that well established theory[4], some researchers indicated that perceived similarity, was positively associated with attraction [52][54] and the attraction is one form of an attitude that is composed of thought, affect, and behavior related to an individual[24]. The underlying logic is that when one individual perceives that he or she is similar to the other, it would be more likely for the individual to show positive attitudes towards the other. According to the literature of similarity attraction theory, it is typically examined among strangers [44], so it is suitable to be used in the eWOM environment where most individuals are unfamiliar with each other. Therefore, in this study, we attempt to
apply the similarity attraction theory to understand the impacts of perceived similarity on argument strengths and source credibility.

**Susceptibility to Social Influence**

Social influence was a significant focus of the field of social psychology [38]. And this focus was evident in early interest in phenomena such as sympathy, imitation, suggestion, the crowd, and group minds. Susceptibility to social influence has been considered as the need to identify or enhance one's image with others through the acquisition, or the willingness to comply to the expectations of others [2]. Generally, researchers have agreed that susceptibility to social influence in groups primarily focuses on two types of influences: informational influence and normative influence [33].

The susceptibility to informational influence could result from information obtained as evidence about reality and often is based on the receiver’s self-judgment of information they have received [19], whereas susceptibility to normative influence refers to the effect to the individual that arises from the norms of other individuals in their preference of the group [15]. The underlying logic is that when one individual decides to adopt one view from the internet, it might result from the susceptibility to informative or normative influence.

Numerous researches from psychological and consumer research have documented the existence of interpersonal influence upon decision processes [2]. For example, the researcher has suggested that susceptibility to social influence could affect consumer decision processes when they evaluate product [48]. Further, theories and research on social influence in groups suggest that susceptibility to normative influence can be detrimental to important group decision-making [31]. Social psychological studies of susceptibility to influence have suggested that social influence could bring about change in another person [38]. It indicates that social influence could affect beliefs, which in turn affects attitudes and behaviors [25]. In fact, interpersonal influence is manifested through either susceptibility to normative or informational influences [19]. However, considering the virtual context where individuals might find it difficult to justify the authenticity of information directly, we consider the susceptibility to normative influence would play a more significant role under this context. Therefore, in this study, we use the normative susceptibility to understand how it affects individuals’ evaluation of reviews under the eWOM environment.

**RESEARCH MODEL AND HYPOTHESES**

We propose our research model in Figure. 1. In the model, argument strength and source credibility of eWOM are regarded as two crucial predictor of consumer’s evaluation of the review helpfulness. Further, source credibility of eWOM are influenced by two factors capturing the social relationship between the review provider and recipient namely tie strength and perceived similarity. We also introduce recipient’s normative susceptibility to social influence as moderators in the model, moderating the impact of tie strength and perceived similarity on source credibility, as well as the impact of source credibility and argument strength on review helpfulness.

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Systematic Factor and Heuristic Factor on Information Adoption

Argument strength is the extent to which the information recipients view the argument as convincing or valid in supporting its position [13]. A high level of argument strength indicates the information is justified and compelling. Zhang et al. [60] pointed out that for the systematic processing, individuals develop their perceptions mainly regarding the information contents (e.g., argument strength). Recent researches have demonstrated that argument strength has proved to be an important element that people use to evaluate incoming communications [13].

In this paper, we also define product review helpfulness as the extent to which consumers perceive the product review as being capable of facilitating judgment or purchase decisions. We adopt two important dimensions (i.e., perceived content diagnosticity and perceived vicarious expression), which are both included in the formative construct of product review helpfulness according to Bach’s (1967). Perceived content diagnosticity refers to the extent to which a review discriminates between alternative interpretations of a problem and possible solutions to it [32]; and vicarious expression demonstrates the degree to which reviews convey vivid experiences of a product that can be felt by readers [28]. Both of them are able to examine the ultimate effect of the eWOM information process on individuals.

Since online reviewers’ perceived value of the information that help to reduce their uncertainties when considering a potential purchase, assist their decision-making, and even help to influence their purchase decisions. We propose that argument strength of eWOM is an important systematic factor of recipients’ perceived review helpfulness. To be specific, when consumers carefully read a review and contemplate its validity, they are engaging in systematic information processing [63]. The more persuasive the information embedded in the review is, the higher strength consumers will perceive the content-based arguments to be, and the more likely that they will perceive the message is helpful. Thus, the following hypothesis is proposed:

**H1.** Argument strength positively affects eWOM review helpfulness.

Source credibility can be defined as recipients’ perception about the credibility of the source of a review rather than the content of this message [5]. It captures the expertise and trustworthiness [11]. Recent studies [13] showed that for the heuristic processing of HSM, individuals develop perceptions which are related to some contextual cues, such as the characteristics of the information source (e.g., source credibility). Sussman and Siega (2003) suggested source credibility functions as a heuristic cue would function in the email context. Zhang and Watts (2008) also found source credibility exerts a significant impact on individuals' online information adoption behavior in the online environment.

Thus, in the eWOM environment, reviews which provide reliable information can help readers learn more about the online products and improve their decision-making abilities. From this perspective, source credibility is a relevant and applicable heuristic cue of HSM in eWOM contexts. So we posit that online consumers adopt source credibility as an important heuristic factor to form their information adoption. If a consumer finds that the comment is posted by high-credibility (i.e., high degree of expertise and trustworthiness) individuals for the given product, it is more likely to enable him/her to conclude that the review is helpful. This leads us to hypothesize:

**H2.** Source credibility positively affects eWOM review helpfulness.

According to the heuristic-systematic model, the co-occurrence of two information processing modes is one of the important theoretical extensions. Further studies pointed that heuristic processing can bias systematic processing by affecting information recipients’ expectations or inferences about the validity of arguments [6][10]. For example, information received from a recognized expertise, rather than from an anonymous person, may be perceived as more valid. This also seems to be the case of eWOM. There are plenty of eWOM reviews from homogeneous online consumers, who are relative “ambiguous” and amenable to diverse interpretations [20]. Readers would like to find online reviews from credible sources are more convincing than those from non-credible sources, and then they can develop expectancies regarding the argument strength of these reviews.

Zhang and Watts (2008) recently found some support for the bias effect in a post-hoc analysis by using survey data and highlighted the indirect effect of heuristic cues. Eagly and Chaiken (1993) also found that source credibility and perceived quantity of reviews (heuristic factors) have direct impacts on purchase intention. These studies above proved that systematic factor (e.g., argument strength) had the strongest direct effect on behavioral intention, whereas heuristic factor (e.g., source credibility) had the strongest total effect.

In this study, we examine the bias effect in HSM by positing that source credibility of reviews (heuristic factor) can bias the evaluation on argument strength (systematic factor). Thus, we propose:

**H3.** Source credibility positively affects argument strength.

Social Relationship and Review Evaluation

Tie strength characterizes the closeness and frequency of interaction in a relationship between two parties [30]. On the context of online review sites, tie strength among online users would be stronger through their frequent interactions, including checking
others’ review updates, editing comments to others’ reviews, initiating discussions on a product evaluated in the reviews, or sending virtual gifts to others as a form of support or appreciation[59]. Previous researchers shows that tie strength has potential to significantly impact social media users [27], which indicates that it could play a vital role in the process of users’ decision-making and may even influence the understanding of their opinions.

As previous researches on social capital theory indicate, structural capital, which is in the form of social interaction, can positively affect cognitive capital and relational capital. In this study, we propose that structural capital can be reflected by the measurement of tie strength, which is also in the form of social interaction. Additionally, by building trust[58], norms of reciprocity, and mutual respect [41] social interaction could contribute to the development of relational capital. Source credibility in this study is viewed as an indicator for relational capital, affected by social interaction.

Interacting with and collecting feedback from each other have been consistently emphasized as a vital process to develop a common understanding between users (Pawlowski and Daniel, 2004) and also the building of trust relationships with them [43]. Similarly, some researchers also apply this inner relationships among the three dimensions of social capital into IT service delivery context [36][42][55]. We argue that, in eWOM context, interaction between review provider and recipient can generate initial trust and common understanding towards products. Thus, we hypothesize that:

**H4: Tie strength positively affects source credibility.**

Perceived similarity refers to the extent to which individuals are similar regarding certain attributes [3], such as values, tastes, and experiences[18]. In this study, we focus on the tastes about a certain product between review recipient and provider. According to similarity-attraction theory, online consumers may show liking or preference towards people with similar tastes. We believe that such liking can lead to individual’s positive attitude when receiving information from similar ones.

Recent research on this theory classifies similarity into different categories according the levels of similarity such as demographic similarity and deep level similarity [40]. For example, Lankau et al. (2005) examined the role of deep level similarity and surface level similarity in formal mentoring relationships. Moreover, Nass and Lee (2000) indicated that participants would like and trust a voice from a personality similar to their own. In our research context, when the recipient of online reviews considered that the source of the reviews is similar with him/her, s/he may demonstrate high trust on the source. Therefore, we hypothesize that:

**H5: Perceived similarity positively affects source credibility**

**Moderating Effect of Recipient’s Normative Susceptibility**

As we proposed before, tie strength may pose a positive effect on source credibility, that is, if a recipient have strong tie with the review provider, s/he may perceive the provider credible.

As said before, susceptibility to normative influence refers to the effect to the individual arising from the norms of other individuals in their preference of the group [15]. Thus, in this study, we propose that people with strong tie strength to some extent can be seen as a group or community, though virtual. Therefore if a review recipient has high susceptibility to normative influence, s/he would care about people in this group or community and perceive them as credible. In other words, people susceptible to normative influence are easier to let tie strength affect their judgment of whether the source is credible. On the contrary, if an individual is not susceptible to normative influence, whether or not other people are in the group or community tends not to affect his/her perception of source credibility. The perception whether a source is credible or not is a relatively independent process and is immune to his/her social relationship with the target information source. Based on such difference, we hypothesize that:

**H6: Recipient’s susceptibility to normative influence positively moderates the effect of tie strength on source credibility.**

According to similarity attraction theory, people tend to build initial trust with ones who are similar to them in some aspects. This tendency can actually be viewed as people’s inclination to keep consistent with others’ norms or expectations.

According to the definition of susceptibility to normative influence[15], people susceptible to normative influence care about others’ opinions and tend to behave according to the norm and others’ expectation. In this study, the variable perceived similarity plays a role as common features representing a kind of expectation or norm they shared between the review recipient and provider. In this context, therefore, a person with high susceptibility to normative influence cares more about such shared norm or expectation and so could build initial trust easier, perceiving the source as credible. By contrast, when an individual has low susceptibility to normative influence, norm or expectation means little to them, leading that the initial trust can be hardly built result from the existence of perceived similarity. That is, this kind of people are less likely than people susceptible to normative influence to perceive a source credible even they have some common features with the source. It indicates that the effect perceived similarity exerting on source credibility may show different extent among people with different level of normative susceptibility. Thus, we hypothesize that:

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H7: Recipient’s susceptibility to normative influence moderates positively the effect of perceived similarity on source credibility.

According to HSM, systematic processing might require motivation, ability and sufficient cognitive resources, and some researchers believed that this processing will be limited if one chooses not to understand the message or is not mentally capable of understanding the message[63]. Considering the definition of susceptibility to normative influence, individuals who mark the level of it with low scores are not easily affected by others, and this means that they would struggle to comprehend the information by themselves. Thus, those people might prefer process the information through systematic processing. On the contrast, heuristic processing might depend on the availability of cues and also awareness of the heuristics associated with these cues. It means that if a cue is not available to the information recipient, or if the information recipient is not aware of the contents of the cue, he or she cannot process the content heuristically. Since people who mark the level of it with high scores tend to follow others, they are willing to gather cues provided by others in the eWOM environment, which definitely prompts the heuristic processing to some extent. It indicates that those people tend to process the reviews through the heuristic processing. According to the difference explained above, we hypothesis that:

H8: The susceptibility to normative influence negatively moderates the effect of argument strength on information adoption.

H9: The susceptibility to normative influence positively moderates the effect of source credibility on information adoption.

METHODOLOGY

Research Settings

We employ a famous Chinese online review sites named Dianping.com as the research context to examine the influence of eWOM. Since Dianping is one of the most popular online review sites in China, there are many users providing and receiving reviews on entertainment services. By the first quarter of 2015, Dianping.com has more than 200 million active users and the reviews cover 14 million vendors across 2,500 Chinese cities. Additionally, Dianping.com has a reputation rating mechanism, offering the information to reflect ranking levels of different review contributors. From this perspective, we believe that Dianping.com is an appropriate research site for online consumers’ information adoption.

Measures

In this study, all the constructs were measured by using multi-item scales adapted from validated measures in prior studies. Minor changes were made in the wording of the items to fit the specific research context of the Dianping.com. Since the instruments were originally developed in English, we firstly translated the questionnaire into Chinese, and back-translated from Chinese to English in order to administrate the survey study in China. If there were problems (e.g., disagreements or inconsistencies) during the translation process, we solved it by assuring that the final Chinese instruments had sufficient translation quality. Furthermore, we conducted a pilot survey and distributed it to a number of users of Dianping.com. We used feedback collected from usable responses to the pilot survey to refine our items and made the final survey. Measurement items are shown in appendix B. All items were measured using multi-items with five-point Likert scales, from 1 = strongly disagree to 5 = strongly agree.

Data Collection

We distributed URLs of the final questionnaire to people who have certain experience in the Dianping.com. We found suitable participants by several different ways. First, we found some college students and friends who have experience in the Dianping.com. Second, we contacted with the reviewers whose contact ways were showed in the Dianping. In addition, we also sent short messages to the followers of the Dianping’s official micro-blog account. All the information or messages which have been sent to the participants included a URL of the questionnaire accompanied with a brief introduction of our study. Some incentives (e.g., prepaid phone card) were provided through a lucky draw to encourage participation.

We sent 1000 invitation letters, which included short messages, in total and finally gathered 230 usable responses. In the sample, 61.3% of the respondents were women and 38.7% were men. The average age was 22 years. Besides, a clear majority of the respondents (71.7%) had used the internet over six years, which indicates they have abundant experience for it.

DATA ANALYSIS

Partial Least Squares (PLS) Graph 2.0 was used to analyze the data and examine the hypotheses. As a second-generation multivariate technique, PLS could simultaneously assess the measurement model and the structural model. PLS requires a relatively small sample size, has no restriction on normal distribution, so it is more suitable for exploratory analysis[14]. Thus, PLS is more appropriate for this study. Following the two-step analytical procedures, we examine the measurement model and the structural model respectively.

Measurement Model

The measurement model was assessed by the full sample and each subgroup separately. Reliability, convergent validity, and discriminant validity were three indicators of the goodness of the measurement model. Reliability can be assessed by using composite reliability, and average variance extracted (AVE) [26]. Specially, Fornell and Larcker (1981) proposed 0.7 and 0.5 as the threshold value of composite reliability and AVE, respectively. As shown in Table 1, all the constructs were of good reliabilities. Convergent validity was assessed by checking the loadings to see if items within the same construct have high loading values. Loadings of all the items on their respective latent construct were all higher than 0.7 in this study, indicating good
convergent validities. Besides, Discriminant validity could be assessed by comparing the square root of AVE of a construct and correlations of that construct with the other constructs: if the square root of AVE is higher than any correlations related to this construct, acceptable discriminant validity is indicated[26]. The results show that all the constructs have good discriminant validity.

Table 1. RELIABILITY AND DISCRIMINANT VALIDITY

<table>
<thead>
<tr>
<th>Composite</th>
<th>AVE</th>
<th>AS</th>
<th>PS</th>
<th>RH</th>
<th>SC</th>
<th>TS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Combined Group</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AS</td>
<td>.912</td>
<td>.721</td>
<td>.849</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PS</td>
<td>.886</td>
<td>.722</td>
<td>.478</td>
<td>.850</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RH</td>
<td>.924</td>
<td>.669</td>
<td>.320</td>
<td>.309</td>
<td>.818</td>
<td></td>
</tr>
<tr>
<td>SC</td>
<td>.860</td>
<td>.608</td>
<td>.477</td>
<td>.367</td>
<td>.315</td>
<td>.780</td>
</tr>
<tr>
<td>TS</td>
<td>.933</td>
<td>.824</td>
<td>.361</td>
<td>.390</td>
<td>.072</td>
<td>.279</td>
</tr>
<tr>
<td><strong>Low-RN Group</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AS</td>
<td>.893</td>
<td>.676</td>
<td>.822</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PS</td>
<td>.903</td>
<td>.756</td>
<td>.464</td>
<td>.869</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RH</td>
<td>.921</td>
<td>.921</td>
<td>.321</td>
<td>.330</td>
<td>.960</td>
<td></td>
</tr>
<tr>
<td>SC</td>
<td>.853</td>
<td>.852</td>
<td>.389</td>
<td>.303</td>
<td>.239</td>
<td>.923</td>
</tr>
<tr>
<td>TS</td>
<td>.918</td>
<td>.790</td>
<td>.206</td>
<td>.422</td>
<td>.057</td>
<td>.177</td>
</tr>
<tr>
<td><strong>High-RN Group</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AS</td>
<td>.924</td>
<td>.752</td>
<td>.867</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PS</td>
<td>.830</td>
<td>.626</td>
<td>.443</td>
<td>.791</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RH</td>
<td>.927</td>
<td>.680</td>
<td>.295</td>
<td>.239</td>
<td>.825</td>
<td></td>
</tr>
<tr>
<td>SC</td>
<td>.853</td>
<td>.599</td>
<td>.517</td>
<td>.373</td>
<td>.376</td>
<td>.748</td>
</tr>
<tr>
<td>TS</td>
<td>.936</td>
<td>.830</td>
<td>.438</td>
<td>.249</td>
<td>.029</td>
<td>.285</td>
</tr>
</tbody>
</table>

Note: The numbers in bold in diagonal row of the correlation matrix are the square root of AVE. AS, argument strength ; PS, Perceived similarity ; RH, review helpfulness ; SC, source credibility. TS, tie strength Low-RN group where reviewers mark the susceptibility to normative influence <= 2.875; High-RN group where reviewers mark the susceptibility to normative influence > 2.875

Structure Model

With adequate measurement models, the hypotheses were tested by examining the structural models. And in order to see different influence among people with different levels in susceptibility to normative influence, we depict the structural models for combined group, the Low-RN group, and High-RN group respectively. The explanatory power of a structural model could be evaluated by looking at the R² value (variance accounted for) in the final dependent construct. In this study, the final dependent construct (review helpfulness) had R² values of 0.136 for the combined dataset, 0.118 for Low-RN group and 0.156 for High-RN group, making interpretation of path coefficients meaningful. Besides, with a one-tailed five percentage level of significance, the acceptable T-value in this study would be 1.650.

Following Keil et al (2000), the moderating effect of tie strength was tested by comparing path coefficients of the same relationship for low-RN group and high-RN group based on the PLS analysis (details of the analysis, see Appendix A). The results indicated that perceived similarity had significant effect on source credibility in all three groups, with combined group (β=.306, t=4.760), Low-RN group (β=.278, t=3.113), and in High-RN group (β=.322, t=3.267). Besides, the results also indicated that tie strength had significant effect on source credibility in the combined group (β=.160, t=2.470) and High-RN group (β=.204, t=2.083), but insignificant in Low-RN group (β=.060, t=.791). Also, source credibility had effect on review helpfulness in the combined group (β=.209, t=2.925) and High-RN group (β=.305, t=2.950), but insignificant in Low-RN group (β=.134, t=1.330) In contrast, argument strength was significant for both combined group (β=.220, t=2.615) and Low-RN group (β=.269, t=2.560) but insignificant for High-RN group (β=.137, t=0.968). The results also indicated that source credibility had significant effect on argument strength in all three groups, with combined group (β=.478, t=8.072), Low-RN group (β=.389, t=4.369), and in High-RN group (β=.517, t=7.112). Further, Table 2 listed the path coefficients comparision results according to path coefficient comparison method. See appendix A for details about the method applied to. Results showed that the path loadings of perceived similarity- source credibility (t= -3.589, p<0.001) and tie strength- source credibility (t= -12.199, p<0.001) were significantly different for low-RN group and high-RN group. Results also indicated that the path loadings of argument strength- review helpfulness (t= -8.175, p<0.001) and source credibility – review helpfulness (t= -12.365, p<0.001) were significantly different for low-RN group and high-RN group. Above all, all the hypotheses were supported.
Key Findings
This study attempts to explore antecedents of source credibility and the boundary conditions under which the antecedents exert their impacts on source credibility. With HSM, we adopt similarity-attraction theory, social capital theory and social influence model to our research and several key findings can be derived from the study.

First, this study shows that the perceived similarity between individuals can influence the level they perceive the review source as credible, which indicates that when people suppose they are similar with the reviewers, they tend to believe the reviewer as trustworthy. Additionally, this influence is intensified when individuals have high susceptibility to normative social influence. That is to say, one tends to find that perceived similarity plays a more important role on his/her justification on the source credibility, if she or he cares more about how other people see him/her, or pay more attention to the norm.

Second, we also find that source credibility could be affected by tie strength between review provider and recipient. The underlying logic is that with much stronger tie strength (e.g., more frequent interaction), the individuals would perceive the shared representations and interpretations between them is stronger, and trust is more likely to engender. And this impact is also intensified by high normative susceptibility: the more individuals are receptive to other’s behavior, the more significant the impact exerted on source credibility by tie strength is.

Finally, this study reveals that the recipient’s susceptibility to social influence plays a role as the moderator in information evaluation behavior. The high susceptibility to normative influence strengthens the impact of source credibility on review helpfulness as well as on argument strength, but weakens the effect of argument strength on review helpfulness. It indicates that if an individual is receptive to normative influence, heuristic factor (i.e., source credibility), instead systematic factor (i.e., argument strength) plays more significant role on review evaluation, and vice versa.

Theoretical Implications
This study can offer several important and interesting insights to information systems research.

First, this study extends the HSM by introducing social relationships to information evaluation behavior. Even though a large number of researchers have conducted key findings about this model, most of them pay attention to how influential it is in the field of persuasion and attitude change [53][62], few of them considered which factors would affect the variables in HSM. This study shows that tie strength and perceived similarity affect source credibility, supported by social capital theory and similarity-attraction theory. To our knowledge, few prior researches applied the two theories, especially the similarity-attraction theory, to explain information adoption behavior or to combine them with HSM. The current study can therefore be regarded as an exploration to fill this research gap by providing a footstone for further theoretical development.

Moreover, this study enriches the HSM literature by adding susceptibility to social influence as moderators in information evaluation. It is found that susceptibility to normative influence can strengthen the impact of tie strength and perceived similarity on source credibility. That is when the level of susceptibility to normative influence is low, an individual might prefer to process the information through systematic processing (i.e., argument strength); while when it is high, he/she prefers the heuristic processing (i.e., source credibility).

DISCUSSION AND IMPLICATIONS

Table 2. MODEL SUMMARY: STATISTICAL COMPARISON OF PATHCOEFFICIENTS

<table>
<thead>
<tr>
<th>Construct</th>
<th>Combined group</th>
<th>Low-RN group</th>
<th>High-RN group</th>
<th>Low-RN High-RN group vs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived Similarity</td>
<td>β</td>
<td>t-value</td>
<td>β</td>
<td>t-value</td>
</tr>
<tr>
<td>Tie Strength</td>
<td>.305***</td>
<td>4.760</td>
<td>.278***</td>
<td>3.113</td>
</tr>
<tr>
<td>Construct</td>
<td>Argument Strength</td>
<td>.160***</td>
<td>2.470</td>
<td>.060</td>
</tr>
<tr>
<td>Source Credibility</td>
<td>.220***</td>
<td>2.615</td>
<td>.269***</td>
<td>2.560</td>
</tr>
<tr>
<td>Note: *p&lt;0.05, **p&lt;0.01, ***p&lt;0.001</td>
<td></td>
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</tbody>
</table>
Finally, this study examines the two routes: systematic and heuristic, in HSM play significant role under what condition respectively. The study shows that if an individual is susceptible to normative influence, heuristic factor (i.e., source credibility), instead of systematic factor (i.e., argument strength) plays the significant role on review evaluation, and vice versa.

**Practical implications**

Apart from the theoretical implications, this study also contributes a lot for practitioners. The most obvious practical implication is that eWOM service providers should improve the social networking functions so as to enhance users’ social relationships. For example, registered reviewers can be encouraged to express their own experiences about products, share what they’re interested in, tag products they have purchased, and keep discussing with other online users. As discussed before, social relationship plays a significant role in individuals’ final decision.

Second, a rating mechanism should be established in online eWOM sites. According to both direct and indirect effects of heuristic cues, source credibility has significant positive effect on users’ perceived information helpfulness and thus the process of purchase decision-making. So designers should encourage reviewers to provide useful reviews by setting up a rating system which can reflect contributors’ credibility. This kind of indicators can enable people to gain helpful information which facilitate the purchase process.

**Limitations**

There are several limitations of this study. First, the study only adopt a single online review site (i.e., Diapning.com) as the research context in a single culture (i.e. China) and this might limit the generalizability of the research. Thus when applying the research model or conclusions to other contexts, researchers may consider contextual issues (e.g., culture and the characteristics of different websites).

Second, this study focused on the antecedents and moderators of source credibility and considered only one factor that would moderate the process, some other factors are not included. Future research can add more factors into the research model to see whether or not our proposed relationships are still supported. Finally, although we sent invitations to a great deal of online users randomly, users interested in eWOM should be more likely to fill the survey. Thus, a better sampling method should be considered in future research to avoid the response bias.

**REFERENCES**


APP-PRIVACY AS AN ABSTRACT VALUE – APPROACHING CONTINGENT VALUATION FOR INVESTIGATING THE WILLINGNESS TO PAY FOR APP PRIVACY

Christoph Buck, University of Bayreuth, Germany, Christoph.buck@uni-bayreuth.de

ABSTRACT

Apps can be seen as the embodiment of ubiquitous computing, i.e. the creation of environments saturated with computing and communication capability, integrated with human users. App markets are typical examples of so-called free or freemium markets, i.e. most apps include (at least) a free basic version. However, this does not mean that consumers do not have to pay for the benefits they derive. More precisely, private information of consumers is generated as the majority of apps receives, stores, or processes personal data, although sometimes other revenue mechanisms are used simultaneously. Given the fact that consumers’ information privacy as personal data privacy is a major part of the economic exchange when downloading and using apps, app privacy is determined as an attribute of the value proposition of apps. The current paper approaches the contingent valuation for measuring the willingness to pay for app privacy as an abstract value.

Keywords: Privacy, Security, Willingness to Pay, Contingent Valuation.

INTRODUCTION

Let’s face reality – privacy concerns are ubiquitous, just like smart mobile devices (SMDs) and the vast amount of user data they create. Recent developments in computing and the seemingly endless possibilities of collecting, connecting, processing, and distributing data, sometimes even without the actual knowledge of users, lead to huge amounts of user data [40].

With the disruptive innovations of the iPhone and the iPad, leading to the product class of smart mobile devices (SMDs), software in the form of mobile applications (apps) diffused in the everyday life of consumers. Apps can be interpreted as the embodiment of ubiquitous computing, i.e. the creation of environments saturated with computing and communication capability, integrated with human users [51]. While ubiquitous computing focuses on hardware components, today’s apps are the logical consequence of experiential computing; the “digitally mediated embodied experiences in everyday activities through everyday artifacts with embedded computing capabilities” [53, p. 213].

Apps in combination with SMDs can be regarded as today’s archetype of ubiquitous computing. At the same time, this development has considerably contributed to the emergence of a new user type. These new users integrate apps into their everyday lives, which leads to fundamental changes concerning how users interact with computing devices and systems [46]. SMDs provide plenty of sensors and technical features. Combined with ever-increasing processing power, storage capacity, communication bandwidth, and ever-present WiFi access, mobile technology made the vision of ubiquitous computing come true. The combination of tangible computing, the digitalization of everyday artifacts, and the global infrastructure already became milestones of the integration of apps into everyday life. Thus, apps use the broad opportunities given by integrated sensors, connect several kinds of data, enable new value propositions and provide effective digital solutions for needs previously addressed in a non-digital way.

Apps can be used to perform every kind of task and users benefit, while handling their everyday routine. Everyday activities, e.g., comprising navigation, buying lists, communication, scheduling, gaming, information, sports, and learning, are almost ‘naturally’ carried out or supported through the use of apps, or as Apple puts it in one of their slogans: “There is an app for that” [1].

App markets are typical examples of so-called free or freemium markets, i.e. most apps include (at least) a free basic version [34]. However, this does not mean that consumers do not have to pay for the benefits they obtain. Although there is often no money involved when purchasing an app, the provider does not offer the app ‘for free’. More precisely, consumers’ private information are taken as ‘currency’, as the majority of apps receives, stores, or processes personal data, although sometimes other revenue mechanisms are used simultaneously (e.g. in-app advertising, monetary payment for the app). Nonetheless, consumers can still benefit from ‘free apps’ in exchange for their personal data. Hence, personal data and privacy can be regarded as the predominant ‘currency’ in app markets.

As a reaction to the recent developments in computing and the seemingly endless possibilities of collecting, connecting, processing and distributing, [40] [5], consumers have developed growing privacy concerns. They primarily want to know who is able to access their data, but they are also worried by the general use and sale of it. Consumers’ concerns about privacy lead to an increasing demand for information and a movement for privacy [23] [38]. Although user data might be stolen or used illegally, using it in a legal or permissible way is more common and wide spread [28].

Given the fact that consumers’ information privacy is a major part of the economic exchange, when downloading and using apps, app privacy, and the corresponding settings, have to be determined as an attribute of the value proposition of apps. In order to
understand consumers’ concerns and clearly define the necessity of user data protection, it is crucial to quantify the value of privacy for consumers, using the concept of willingness-to-pay. Therefore, the paper will address the following research question:  

1. Do consumers have a willingness to pay for app privacy?

To answer these research questions, the remainder of this article is structured as follows. In the following section, I will define privacy as a product attribute of apps. Further, I will introduce the underlying terminology of privacy into the digital age and the value of privacy in the context of apps. Following this, I will describe the methodology of the contingent valuation of app privacy and will present the key findings of the study. Finally, I will address some limitations and conclude with suggestions for further research.

**DIGITAL PRIVACY AS PRODUCT ATTRIBUTE**

**Privacy in the Digital Age**

Since privacy is addressed to so many fields of social sciences and different definitions are used in different areas of everyday life, it is known as an „umbrella term” [42]. Thus, the term ‘privacy’ lacks of a holistic definition, due to the different perspectives of varying disciplines [40] [42] [4]. Research in specific areas needs to be more precise about the particular area privacy is focusing on [40] [42]. It is widely agreed on, that privacy “is in disarray and nobody can articulate what it means” [42, p. 477].

First of all, physical and informational privacy have to be distinguished. Physical privacy relates to the “access of an individual and/or the individual’s surroundings and private space” [40, p. 990]. Contrary, informational privacy only refers to information that is individually identifiable or describes the private informational spheres of an individual. Although informational privacy is rooted in the fundamental concept of physical privacy, both are subsumed under the term of “general privacy” [40]. Since this article deals exclusively with informational privacy, I am going to use privacy as a reference for informational privacy. A distinction will be made by stating physical or general privacy, if necessary.

The development of general privacy and in particular of informational privacy, is highly correlated with the evolution of information technology [26] [29] [32] [40]. [50] explains the evolution of privacy in a chronological way consisting of four stages. In the first stage, which ended in 1961, privacy was a social issue of low concern. Similar to the limited developments in information technology [40], privacy was “interesting but neither primary nor even secondary in social and political salience” [50, q. 8]. In the second stage, advocacy journalism and television-age media competition gained more and more importance and started to warn the public audience about privacy breaches, raising the first informational privacy concerns. As a result, the first detailed national survey was conducted in the United States in 1978, showing that already 76% of the subjects believed that “privacy should be added to the rights of life, liberty, and the pursuit of happiness” [50, p. 12], which constitute the most fundamental privileges of the American society. Overall, privacy gained in importance on a social, political, and legal level and lead to the very first generation of privacy acts and laws [50]. The third stage in the 1980s was triggered and accompanied by the technological development of computing and network systems. However, the collection and usage of personal information “did not break new ground” [50, p. 10]. Processing information became cheaper, faster, and more efficient. But since computers were not connected to each other, information remained in separate data bases [50]. Although several federal legislative and governmental activities took place at that point, information privacy remained on the second level of social and political salience. The rise of the Internet, combined with the development of Web 2.0, and particularly the terrorist attacks of 9/11/2011 in the United States, lead to a revolution in privacy issues. Informational privacy became a tier-one social and political topic [40] [50]. Additionally, increasing worldwide communication, trade, travel, and marketing activities resulted in the development of globalization and simultaneous informational collection, as well as in concerns regarding these practices [50]. Back in 1985, computer scientists like Larry Hunter did not expect new developments in gathering, but in analyzing willingly shared information [32]. To implement these developments this article proposes to add a fifth stage to [50] definitional approach, regarding the evolution of the information privacy concept: The fourth Era of Privacy Development (2003-present).

In the 21st century, SMDs conquered the market of consumer electronics. Equipped with sophisticated sensors and advanced computer hardware and software, they entail wide-reaching new ways of collecting and connecting user data [36]. As the “pocket knife of communication” [48], SMDs possess a vast amount of connected sensors, devices, and functions. Throughout these functions, the possibilities of gathering information are virtually endless. Future prospects in relation to these applications promise even more opportunities to expand data collection and immediate analysis of data.

To evaluate privacy as an attribute of apps, it is important to provide a definition and conceptual framework of app privacy. While [12] defines privacy “as a moral right or a legal right”, many researchers suggests privacy as one’s ability to control information about oneself [4]. Researchers in various disciplines stressed control as the key dimension of privacy [40] [4] [22] [30] [33] [37] [41] [44]. The concept of privacy as a legal right in the modern sense, can be traced back to [47], who said the nucleus of privacy is “the right to be left alone.” The vast diffusion of network SMDs via the Internet and the broad access of consumer software, facilitate the development of an active approach to protecting privacy due to SMDs and apps tracking, storing and aggregating personal data without being recognized [11]. Furthermore, privacy means taking control over information about consumers’ lives which is why consumers should be empowered to protect themselves instead of simply allowing them to be passively left alone.
In app markets consumers are able to control their privacy disclosure during the purchase process. Before downloading an app, they have to accept the privacy settings, as part of economic exchange. Thus, consumers can actively control their disclosure of personal data and third parties’ intervention into their privacy. Consequently, consumers have greater responsibility than they had before, using SMDs to decide to which extent they would like to share their personal information in the moment of downloading an app [11].

Privacy in the Context of Apps
The advancements of SMDs, Web 4.0, the Internet of Things (IoT), and other technical revolutions continued to raise more and more concerns about informational privacy [3]. Through these “unprecedented possibilities to collect, store, aggregate and analyze user data” [26, p. 1] via SMDs and apps, privacy concerns remained on the highest tier of public interest. Apps, like traditional software, can be characterized as closed and not integrated software packages, which depend on their underlying operating system (OS) [17]. Apps are “application software programs, which use web and cloud applications and run on SMDs. They can be purchased and installed, depending on their operating system and perform (highly fragmented) everyday tasks. Importantly, apps are embedded in mobile ecosystems, i.e. OS-based platforms, which provide profile-bound ubiquitous services for mobile devices” [7, p. 3].

Regarding data quality, recent developments in mobile technology and an ever increasing digitalization of everyday tasks, lead to an unprecedented precision of continuously updated and integrated personal data, which is generated within mobile ecosystems like iOS and Android. Apps are embedded in a unique architecture, which allows for an aggregation of fragmented pieces of personal data, gained from SMDs and apps, and can be classified in a four-tier model [7].

![Four-Tier Model of App Data Aggregation](image)

The first tier includes basic consumer data, which is required for the enrollment and already generates first-class information to personalize the user profile, for example verified e-mail address, phone numbers, IMEI, UDID and, when using the app store, payment information like credit card and banking information [19]. The second tier represents the ecosystem’s ability to track and store all data generated when using the basic OS. The use of this data can be extended to a moving profile or a far-reaching profile of consumers’ social environment. The third tier refers to the ability of a third party vendor to use specific data of consumers’ app usage. Apps perform everyday tasks; therefore app usage data gives wide-reaching insights into consumers’ everyday lives. In addition, the information can be recorded and personalized by the third party vendor by downlinking it to the OS, and thereby allowing for fundamental insights into consumers’ behavior [18]. Finally, a comprehensive user profile is generated by fourth party aggregators like Google or Flurry, representing the fourth tier. These aggregators gather information from thousands of app vendors and can create a holistic profile of users’ lives. Personal information collected via apps are in a digital format and can be copied, transmitted, and integrated, which enables third parties to construct thorough descriptions of individuals and cause a serious threat to privacy if these information are not handled properly [28].

The mere technical characteristics of apps show the range of privacy issues which are involved when using apps. Because of the everyday life integration, apps address all four privacy dimensions identified by [12]: privacy of a person, personal behavior privacy, personal communication privacy, and personal data privacy. When addressing apps, the most important dimension is the personal data privacy, which directly affects the other three dimensions. Via apps and the mobile internet, real time and real life data can be collected, aggregated, and analyzed faster, in larger volume, and at a greater personal life depth than ever [28], [12] privacy dimensions cover a very broad field and have to be extended by the classification of information privacy of [41], which
can be subsumed under [12] dimensions of privacy of a person. [41] have identified four dimensions of information privacy as personal data privacy: collection, unauthorized secondary use, improper access, and errors dissemination, and invasion. First of all the collection of personal data via apps is multilayered and not transparent for consumers. When downloading an app, consumers have to agree to data permission of providers whose actions and consequences they cannot evaluate. Furthermore, data can be collected without individuals being actually aware of it [5]. The unauthorized second use of data is something consumers often cannot understand and control, moreover often they are not aware of the amount of data being collected. Additionally, the usage refers to data for other purposes than those for which they were originally collected.

Subsequently, the purchase and usage of apps involves privacy risks at a high degree and regarding all dimensions of privacy for consumers. Even though privacy has developed and changed drastically over the last several decades, [49] [50]’s definition from 1967 still holds true: information privacy is defined as “the claim of an individual to determine what information about himself or herself should be known to others” [49, p. 3]. Combining the development of technology, as the influence on informational privacy, and [49] [50]’s definition, it is to scrutinize whether the individuals of the 21st century, with the omnipresent computing of SMDs, are still able to determine what personal information is accessible to others. To pursue this question I will take an in-depth look at the definitional approaches on informational privacy, as well as distinguish privacy from similar and often misinterpreted concepts.

Consequently, in this paper privacy is defined as the ability to control the acquisition and use of one’s personal information [49]. The concept of autonomous and self-determined control over the disclosure of private information is closely related to information and communication technologies and therewith to SMDs and apps [14]. In app markets consumers are able to control their privacy disclosure during the purchasing process. Thus, consumers can actively control their disclosure of personal data and the grasping of privacy from third parties [11]. The current paper exhibits app consumption (for this purpose predefined as the downloading decision) as a highly privacy related behavior, as it covers all four privacy dimensions identified by [12]: personal data privacy, personal communication privacy, personal behavior privacy, and privacy of a person. Via apps and the mobile internet, real time and real life data can be collected, aggregated, and analyzed faster, in larger volume, and at a greater personal life depth than ever [28]. According to [41] consumers’ information privacy as personal data privacy, in the context of the purchase situation, is affected via apps and the mobile internet in terms of collection, unauthorized secondary use, and improper access.

App Privacy as an Abstract Value
[15, p. 61] stated that privacy “is a highly cherished value, few would argue that absolute privacy is unattainable.” While this describes consumers’ perspective, the personal information and highly personalized data collected via apps have a huge economic value. Due to this, users are supposed to undertake an anticipatory, rational weighting of risks and benefits when confronted with the decision to disclose personal information or conduct transactions [28][52].

This perspective leads [6] to bring up the idea of privacy as a commodity. According to this view, privacy is no longer an absolute societal value, but has an economic value, which leads to the possibility of a cost-benefit trade-off calculation made by individuals or a society [40]. An example for this shift from privacy as a right, to an economically exchangeable commodity is summarized under the term of “self-surveillance” [40]: Individuals cooperate in the information gathering process, forfeiting some of their privacy in exchange for a particular benefit [25]. Nevertheless, it remains unclear if this is a simple bargain process or if the current privacy crisis is the result of a market failure by the technological development or existing privacy legislation [21][27]. [13] introduced this privacy trade-off as the privacy calculus, which has been extensively studied in several contexts, such as e-commerce [15], the Internet [28] [16] or mobile applications [52]. The privacy calculus assumes a correct understanding of the monetary value of privacy and therewith a tangible willingness to pay for privacy of the consumers. Most privacy measurement instruments are supposed to be too general to reflect the true essence of privacy-related anxiety [39]. Also there is a fundamental gap between how users claim to feel about privacy and how they act in real-life settings [43][2].

Regarding the pricing of information privacy, the value-based definitional approach towards information privacy, along with its commodity concept, offers the best match with the theory of willingness-to-pay. This is particularly evident in the observation of the phenomenon of the privacy calculus, which was validated by several studies: Consumers consciously calculated cost-benefit trade-offs based on the perceived risks and benefits of an informational disclosure. Both the concepts of maximization and reservation price are based on the perceived value of a product and therefore generally applicable and consistent with the value-based definitional approach of information privacy. The maximization price is based on the consumer’s reference value, arising from the price of an alternative good or service. However, it is not possible to calculate a reference value for information privacy, as there are no alternatives to this particular good or service. Therefore, using the concept of a maximization price to determine a consumer’s willingness-to-pay for privacy is not applicable. On the other hand, the reservation price does not need any reference values of alternative goods or services. It is based on the consumer’s utility or at least at the perceived value a product or service offers. In order to quantify the willingness-to-pay for privacy it is necessary to determine the monetary equivalent, which is based on the consumer’s perceived value. This perceived value individually differs to a large extent due to the simple fact that information privacy is valued subjectively and that the value of certain information types is too abstract to be described successfully. As they also suffering from the privacy paradox, studies and surveys about individuals’ utility functions of

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information privacy were not able to determine such a value after all. Following this, this article defines privacy as an abstract value.

In the end, information privacy is evaluated subjectively by every individual and the value of different information types is abstract and intangible. Taking a closer look at this particular situation, similarities with the paradigm shift from goods- to service-dominant logic in marketing can be detected [45]. As [45] point out, the orientation and the academic focus shifted from tangibles toward intangibles, such as skills, information, and knowledge. While the process of exchanging becomes more important, interactivity, connectivity, and ongoing relationships are also gaining importance. The authors suggest that the “static and discrete tangible good” [45] is no longer the appropriate unit of exchange. Additionally, they argue for operant resources to become the next unit of exchange. They are intangible, continuous, and dynamic and stand for the application of competences, specialized human knowledge, and skills [45]. Applied to the area of information privacy, the service-dominant logic offers a new and more accurate view on what type of product, service or information is traded. It offers a new perspective on the co-creation of information-gathering companies and the users which provide knowledge and skills in form of their user data.

**METHODOLOGY**

**Survey Design**

Based on the classification of app privacy as an abstract value, a contingent valuation (CV) via an online survey was conducted. Due to the fact that transparent and trustable market prices are not available for privacy and personal data contingent valuation is chosen as a qualified instrument to measure the willingness to pay for privacy [9]. Moreover, the loss of privacy is a very subjective procedure which cannot be objectified. To depict a holistic estimation of the abstract value of app privacy of consumers, this methodology was applied because of CVs ability to quantify abstract values. Compared to common approaches of measuring preferences, it is not limited in measuring the utility value based on the observable behavior in related markets [10].

Based on a narrative scenario, participants were asked to appraise their willingness to pay (WTP) for high privacy settings [8]. According to the control-based definition of app privacy and the dimensions of collection, unauthorized secondary use, and improper access, consumers could estimate their WTP for avoiding these risks. In the first place this was implemented by offering a bidding game according to generic app prices to cover the so-called software protection. In the second place participants were asked to mention their WTP for hardware protection through a privacy dongle. Figure 2 illustrates the sequences of the conducted online survey.

![Figure 2. Setup of the Study](image)

After a short introduction in section one of the survey the participants were asked in section two if they have a SMD and if they have ever downloaded an app (filter questions). If participants had no SMD or did never download an app they were excluded from the survey. It must be assumed that experience in the field of app downloading is crucial for valid responses [35]. Following the filter questions participants had to state which apps they have downloaded by means of a list about the 20 most common used apps in Germany.

Departing from classic CV, two different privacy scenarios were designed in the third section. The first narrative scenario was based on the tagesschau app, the app of the federal German news channel. This app is supposed be recognized as a trustworthy app also because of the correspondent federal German news channel. The second narrative scenario was conducted with the instant messaging app whatsapp which can be defined as a non trustworthy app in the consequence of public news about whippets privacy breaches in 2014. Both scenarios were randomly distributed to the participants. Additionally, questions regarding the manufacturer of the used SMDs were asked to classify the participants depending on the underlying ecosystem provider.

The fourth section represents the core of the contingent valuation study. Because of the simplicity of the analysis and convenience of the participants randomly closed-ended questions were used in the survey. The participants were supposed to answer the question about their willingness to pay for a privacy markup of (randomly) 0,49€, 1,99€ or 5,99€ with a dichotomous choice (yes/no). To improve evidence a bidding-game followed to iteratively test consumers’ willingness to pay for privacy markups [24] [31]. Figure 3 illustrates the structure of the bidding game.

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In the fifth section participants were asked about their willingness to pay for privacy enhancing hardware and software upgrades. After stating their preferences in section six, demographics were prompted in section seven.

**Data Collection and Results**

All items regarding consumers’ willingness to pay for privacy were measured on dichotomous scales ranging from “yes” (1) to “no” (2) and pending questions. Data collection took place between June 2014 and October 2014 in Germany. Consumers were invited to participate in an online survey via social media (Facebook, Xing, etc.), (university) mailing lists, and postings on the website of a regional sports club. Altogether, 1171 participants subscribed to the study. 998 participants (85.2%) who use an SMD as well as downloaded at least one app (filter questions) completed the contingent valuation part of the survey and were included in the subsequent data analysis.

Of the remaining individuals, 38.8% (N = 387) were female and 61.2% were male (N = 611). Most of the respondents were younger than 50 years (91.2%; N = 907). The largest group were Teenagers between 13 and 19 years of age (33.5%; N = 334), followed by participants who were younger than 13 years old (25.4%; N=253) and participants between 20 and 29 years of age (33.5%; N = 240). The mean value of the participants age was 20.04 (SD=10.98). Regarding the level of school education it is noticeable that 96.89% have an A-Level/Highschool Certificate (75.55%) or a secondary school level certificate (21.34%). Respondents’ OS-affiliation was identified according to the device manufacturer. 524 participants (52.51%) used iOS and 474 (47.49%) used non-iOS.
Table 1. Descriptive Statistics

<table>
<thead>
<tr>
<th>Gender</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>387</td>
<td>38.78%</td>
</tr>
<tr>
<td>Male</td>
<td>611</td>
<td>61.22%</td>
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<tr>
<td>Total</td>
<td>998</td>
<td>100.00%</td>
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</table>

<table>
<thead>
<tr>
<th>Age</th>
<th>Count</th>
<th>Percentage</th>
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</thead>
<tbody>
<tr>
<td>younger than 13</td>
<td>253</td>
<td>25.50%</td>
</tr>
<tr>
<td>13 to 19 (Teenager)</td>
<td>334</td>
<td>33.67%</td>
</tr>
<tr>
<td>20 to 29</td>
<td>240</td>
<td>24.19%</td>
</tr>
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<td>30 to 39</td>
<td>89</td>
<td>8.97%</td>
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<tr>
<td>40 to 49</td>
<td>60</td>
<td>6.05%</td>
</tr>
<tr>
<td>50 to 59</td>
<td>11</td>
<td>1.11%</td>
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<td>60 and older</td>
<td>5</td>
<td>0.50%</td>
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<tr>
<td>no response</td>
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<td>0.60%</td>
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<tr>
<td>Total</td>
<td>998</td>
<td>100.00%</td>
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<tr>
<th>School Education</th>
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<td>no degree</td>
<td>22</td>
<td>2.20%</td>
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<tr>
<td>Secondary school leaving certificate</td>
<td>213</td>
<td>21.34%</td>
</tr>
<tr>
<td>A level/High-school certificate</td>
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<td>75.55%</td>
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<td>no response</td>
<td>9</td>
<td>0.90%</td>
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<td>Total</td>
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<td>100.00%</td>
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<table>
<thead>
<tr>
<th>Operating System Affiliation</th>
<th>Count</th>
<th>Percentage</th>
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</thead>
<tbody>
<tr>
<td>iOS</td>
<td>524</td>
<td>52.51%</td>
</tr>
<tr>
<td>non-iOS</td>
<td>474</td>
<td>47.49%</td>
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<tr>
<td>Total</td>
<td>998</td>
<td>100.00%</td>
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<table>
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<tr>
<th>Number of downloaded Apps</th>
<th>Count</th>
<th>Percentage</th>
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</thead>
<tbody>
<tr>
<td>1 to 10</td>
<td>188</td>
<td>18.84%</td>
</tr>
<tr>
<td>11 to 20</td>
<td>283</td>
<td>28.36%</td>
</tr>
<tr>
<td>21 to 30</td>
<td>190</td>
<td>19.04%</td>
</tr>
<tr>
<td>31 to 40</td>
<td>102</td>
<td>10.22%</td>
</tr>
<tr>
<td>41 to 50</td>
<td>67</td>
<td>6.71%</td>
</tr>
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<td>51 to 60</td>
<td>33</td>
<td>3.31%</td>
</tr>
<tr>
<td>61 to 70</td>
<td>21</td>
<td>2.10%</td>
</tr>
<tr>
<td>71 to 80</td>
<td>30</td>
<td>3.01%</td>
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<tr>
<td>81 to 90</td>
<td>16</td>
<td>1.60%</td>
</tr>
<tr>
<td>more than 90</td>
<td>49</td>
<td>4.91%</td>
</tr>
<tr>
<td>no response</td>
<td>19</td>
<td>1.90%</td>
</tr>
<tr>
<td>Total</td>
<td>998</td>
<td>100.00%</td>
</tr>
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<table>
<thead>
<tr>
<th>App Experience in months</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>up to 11</td>
<td>120</td>
<td>12.02%</td>
</tr>
<tr>
<td>12 to 23</td>
<td>197</td>
<td>19.74%</td>
</tr>
<tr>
<td>24 to 35</td>
<td>263</td>
<td>26.35%</td>
</tr>
<tr>
<td>36 to 47</td>
<td>198</td>
<td>19.84%</td>
</tr>
<tr>
<td>48 to 50</td>
<td>106</td>
<td>10.62%</td>
</tr>
<tr>
<td>60 to 71</td>
<td>46</td>
<td>4.61%</td>
</tr>
<tr>
<td>more than 71</td>
<td>51</td>
<td>5.11%</td>
</tr>
<tr>
<td>no response</td>
<td>17</td>
<td>1.70%</td>
</tr>
<tr>
<td>Total</td>
<td>998</td>
<td>100.00%</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Downloads of narrative scenario apps</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whatsapp downloaded</td>
<td>906</td>
<td>90.78%</td>
</tr>
<tr>
<td>Whatsapp not downloaded</td>
<td>92</td>
<td>9.22%</td>
</tr>
<tr>
<td>Total</td>
<td>998</td>
<td>100.00%</td>
</tr>
<tr>
<td>News App downloaded</td>
<td>282</td>
<td>28.26%</td>
</tr>
<tr>
<td>News App not downloaded</td>
<td>716</td>
<td>71.74%</td>
</tr>
<tr>
<td>Total</td>
<td>998</td>
<td>100.00%</td>
</tr>
</tbody>
</table>

Concerning the experience variables the data set is structured as following: the participants have downloaded about 30 apps on average (mean value=30.6; SD=24.46). Most people have downloaded 11 to 20 apps in their usage history (28.36%), followed by 21 to 30 apps (19.04%), and 1 to 10 apps (18.84%). The vast majority of the participants had up to 35 month of app experience (88.58%). The largest group were participants with 24 to 35 months of app experience.
Regarding the narrative privacy scenarios the availability of the chosen scenario apps is important. With 90.78% the vast majority of the participants had the instant messaging app whatsapp on their device. The supposed trustworthy app of the German federal news channel (tagesschau) was downloaded by only 28.26% of all participants. For further analyses this seems not to be critical under the assumption that the news channel is well known by all participants as a trustworthy institution.

Table 1 provides an overview regarding the descriptive statistics and the distribution of the participants regarding different classification criteria.

The analysis of the bidding game for the news app produced the following results. The vast majority of the participants had in the first round of the bidding game the willingness to pay for privacy in the 0.49€ game (82.50%) and in the 1.99€ game (78.13). When it comes to pay 5.99€ for a privacy markup 47.83% had the willingness to pay for it. Figure 4 illustrates the detailed results of the bidding game regarding a privacy markup in terms of the trustworthy news app.

In comparison, the analysis of the bidding game for the instant messaging app produced the following results. The vast majority of the participants had in the first round of the bidding game the willingness to pay for privacy in all three game settings. In the 0.49€ game 94.41% had the willingness to pay for the privacy markup followed by 90.06% in the 1.99€ game and 74.42% in the 5.99€ game. Compared with the news app treatment all three games settings had a much higher willingness to pay for the privacy markup. Furthermore, the results from the second round of the bidding games show higher willingness to pay for app privacy in all compared settings.
Using cross tabulation the differences in the answers of participants regarding their willingness to pay for privacy markups in the two conditions of an uncritical and a critical app were compared. The results of the analysis show significant differences ($X^2_{\text{game } 0.49\text{€}}=0.001$; $X^2_{\text{game } 1.99\text{€}}=0.003$; $X^2_{\text{game } 5.99\text{€}}<0.001$) for the two conditions in terms of their initial willingness to pay for privacy markups (round 1). Thus, in case of being confronted with a critical app consumers have a significantly higher willingness to pay for privacy markups when the perceived insecurity of the app is rather low.

Furthermore, the results demonstrate that in the case of a rather low price (0.49€) for a privacy markup and in the case of a rather high price (5.99€) consumers’ willingness to pay even more than the initial price was significantly higher ($X^2_{\text{game } 0.49\text{€}}=0.002$; $X^2_{\text{game } 5.99\text{€}}<0.003$) in the critical app condition than in the non-critical app condition. However, no differences between the participants in the two conditions were observed regarding their willingness to pay a lower price than the initially offered price for a privacy markup.

LIMITATIONS

The paper deals with the question whether consumers have the willingness to pay for a privacy markup in a given app privacy settings. The results of the conducted contingent valuation show that most consumers do have the willingness to pay for a privacy markup. Due to the nature of the research in the field of contingent valuation, the study has some limitations. For example, while in this paper I refer to the ‘consumption’ of apps, it must be recognized that I limited my considerations to ‘purchasing’ apps. However, I am aware that consuming apps also includes app usage and deletion, which should be considered in future studies related to the topic. The chosen sample is not representative of all app consumers, as it includes a large group of students and younger people. The predefined starting points of the bidding game settings of 0.49€, 1.99€ and 5.99€ are generic not validated by results of earlier research.

CONCLUSION AND FUTURE RESEARCH

With the download of an app, consumers potentially give away their personal data without knowing what the publisher or the OS provider is using it for. Although a considerable amount of information on the use of consumers’ data is provided within the app stores, it is questionable if consumers use and evaluate the information in a suitable manner. The minimized information consumption and its misinterpretation are caused by the distorted perception of apps and therewith by the distorted risk perception. Nevertheless, the download and usage of apps are characterized by a typical situation of economic exchange: according to the view of privacy as commodity consumers pay a vast number of apps with their disclosed personal data. The presented paper defines privacy as an abstract value which is difficult for consumers to evaluate. With the approach of the contingent valuation the paper provides a first step in validation consumers’ willingness to pay for privacy.

Nevertheless, because of the increasing importance of personal information and increased security breaches in a more and more interconnected and digitized world privacy and its evaluation further research on privacy is necessary.

REFERENCES

[6] Bennett, C. J. (1995) ‘The political economy of privacy: a review of the literature’, Center for social and legal research, DOE genome project (Final draft), University of Victoria, Department of Political Science, Victoria, Canada.


APPLYING AN EYE-TRACKER TO STUDY EFFECTS OF USING HUMAN PRESENTER IN PRODUCT IMAGE
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Pimmanee Rattanawicha, Chulalongkorn University, Thailand, pimmanee@cbs.chula.ac.th

ABSTRACT
This study applies an eye-tracker to investigate effects of using human presenter in product images. Fixation duration of five different product images on e-commerce webpages were collected using Mirametrix S2 Eye Tracker. The five different product images are [2] using no human presenter in product image, [1] using male presenter with positive emotion (smiling face) in product image, [3] using male presenter with neutral emotion in product image, [4] using female presenter with positive emotion (smiling face) in product image, and [6] using female presenter with neutral emotion in product image. This study was conducted in a laboratory. The data was collected from 100 undergraduate students from Chulalongkorn Business School, Thailand. The result indicates that product image with positive emotion female presenter gets the highest fixation duration, however, not significantly higher than fixation duration of other types of product images.

Keywords: Human Presenter, Product Image, E-commerce, Eye-tracking, Fixation duration.

INTRODUCTION
Nowadays, technology has played an important role in medical, education, communication, and especially in marketing. If organizations use technology effectively, they will be able to create advantages over their competitors. Researchers use many tools for collecting data such as questionnaires and interviews. However, questionnaires and interviews may not be the most suitable tools for collecting eye-gaze data. On the other hand, eye-tracking devices such as Mirametrix S2 Eye-tracker have been used to collect such eye-gaze data.

S2 Eye-tracker is an eye-tracking technology by Mirametrix (http://www.mirametrix.com) which can collect eye-gaze data, provide important analysis tools, and record video of eye movements. Eye-tracking tools have been applied to studies in many different fields. However, because of the increased importance of e-commerce, in this study, S2 Eye-tracker by Mirametrix is applied to study effects of using human presenter in product image used in e-commerce webpages.

RESEARCH OBJECTIVES
This paper has three objectives which are:
1. To study how eye-tracking technology such as Mirametrix S2 Eye-tracker can collect eye-gaze data from visitors of e-commerce webpages.
2. To use the collected eye-gaze data from Mirametrix S2 Eye-tracker to calculate “fixation duration” or how long visitor spends looking at some specific areas of a webpage (area of interest, or AOI).
3. To compare fixation duration of five different product images on e-commerce webpages which are:
   - Using no human presenter in product image.
   - Using male presenter with positive emotion (smiling face) in product image.
   - Using male presenter with neutral emotion in product image.
   - Using female presenter with positive emotion (smiling face) in product image.
   - Using female presenter with neutral emotion in product image.

RESEARCH METHODOLOGY
There are three research tools in this study.
1. S2 Eye-tracker and Viewer by Mirametrix (http://www.mirametrix.com), as shown in Figure 1. S2 Eye-tracker is a portable hardware device that is put below the computer screen. It calibrates almost instantly and holds calibration well. Viewer is software for recording an eye tracking session. It works in the background to create a video of the screen, with red dots for tracking the eye, showing where the user is looking at that moment in time. Viewer can also save the eye-gaze data as an XML or CSV document for later processing. In this study, eye-gaze data is collected in CSV document.
2. Five e-commerce webpages, with five different product images as mentioned earlier, but same design and content in each pages, as shown in Figure 2, 3, 4, 5, and 6.

Figure 2 – Webpage using no human presenter in product image.

Figure 3 – Webpage using male presenter with positive emotion (smiling face) in product image.

Figure 4 – Webpage using male presenter with neutral emotion in product image.
3. **Questionnaire for collecting participants’ data.** This questionnaire is divided into four parts. The first part is used to collect demographic data such as gender, age, and experiences with Internet shopping. The second part collects participants’ vision condition, usual or unusual (such as Myopia, Hyperopia, or Astigmatism). The third part is to double check if each participant really looks at the webpage or not (by asking something specific about the product on webpages). And the final part is to ask participants about product (cake) purchase behavior such as how often he/she buys the product, reasons why he/she buys the product, his/her opinions about using human presenter in product image, and so on.

**Procedure**

Nielsen (2006) suggested using about 20 subjects when collecting usability data. Since we have five different product images to compare in this study, we collect data from 100 participants (20 subjects x 5 different product images). We conducted this study in these following steps:

1. The information about this research was announced to students. Each volunteer participant made appointment with his/her convenient date and time. For the data collection process, data can be collected from one person at a time.

2. Each participant came to his/her appointment.

3. Participant listened to an explanation about the study and steps of data collection before starting the data collection process. Then, if the participant agreed, he/she signed the consent form allowing us to use his/her data in the study.

4. Participant adjusted his/her seat in front of the computer with S2 Eye-tracker. Then, we set Eye-tracker in accordance with participant’s seat for reducing error in data collection.

5. We started the program called “Tracker”, as shown in Figure 7, to calibrate participant’s eye gaze accurately and precisely before starting data collection. Participant looked at each of the 9 points appearing on the computer screen. After that, program displayed participant’s eye-gaze result. As shown in Figure 8, average error value (Ave.err.) should be less than 80, the acceptable score. If not, we have to redo the calibration process until average error value becomes less than 80.
6. After calibration was finished, we ran another program called “Viewer” to record participant’s eye-gaze data in CSV document and participant’s fixation trace video. Then, we asked each participant to view an e-commerce webpage. When the participant finished working with the webpage, we stopped recording eye-gaze data and participant’s fixation trace video.

7. Lastly, participant was asked to fill in the questionnaire to collect participant’s demographic data, as well as other data and opinions for the study.

**Measurements**

In this study, participants were asked to view e-commerce webpages. We were interested in participants’ fixation duration when they looked at product images on our experiment webpages. Hence, we defined product image on webpages as our area of interest (AOI). After data collection from Eye-tracker was finished, we filtered participants’ fixation data in CSV document to calculate fixation duration of each participant for product image or our area of interest (AOI).

**Participants**

One hundred volunteer participants who were undergraduate students from Chulalongkorn Business School participated in this study. A summary of demographic information of 100 participants is shown in Table 1. The participants were 75.0% female, average age of 20.4 years old, and 71.0% of them had Internet shopping experience.

<table>
<thead>
<tr>
<th>Demographics</th>
<th>Distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>25.0% male, 75.0% female</td>
</tr>
<tr>
<td>Age</td>
<td>Average age of 20.4 years old</td>
</tr>
<tr>
<td>Internet shopping experience</td>
<td>29.0% No shopping experience</td>
</tr>
<tr>
<td></td>
<td>71.0% With shopping experience</td>
</tr>
</tbody>
</table>

**RESULTS**

As mentioned earlier, there are five e-commerce webpages, with five different product images in this study, one product image on one webpage. The 100 volunteer participants were divided into 5 groups, one group for one product image (or one webpage). So, 20 participants (5 males, 15 females) were assigned to one product image. In group 2, participants viewed the e-commerce webpage using no human presenter in product image. In group 2, participants viewed the e-commerce webpage using male presenter with positive emotion (smiling face) in product image. In group 3, participants viewed the e-commerce webpage using male presenter with neutral emotion in product image. In group 4, participants viewed the e-commerce webpage using female
presenter with positive emotion (smiling face) in product image. And group 5, participants viewed the e-commerce webpage using female presenter with neutral emotion in product image.

Table 2 – Average Fixation Duration for Five Groups

<table>
<thead>
<tr>
<th>Product Image</th>
<th>Average Fixation Duration (Second)</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>No human presenter</td>
<td>3.988</td>
<td>2.260</td>
</tr>
<tr>
<td>Male presenter with positive emotion.</td>
<td>3.820</td>
<td>2.466</td>
</tr>
<tr>
<td>Male presenter with neutral emotion.</td>
<td>4.378</td>
<td>2.188</td>
</tr>
<tr>
<td>Female presenter with positive emotion.</td>
<td>5.107</td>
<td>3.534</td>
</tr>
<tr>
<td>Female presenter with neutral emotion.</td>
<td>5.031</td>
<td>2.463</td>
</tr>
</tbody>
</table>

As shown in Table 2, the result indicates that product image with female presenter showing positive emotion (smiling face) gets the highest average fixation duration. However, product image with male presenter showing positive emotion (smiling face) gets the lowest average fixation duration. Then, we used Analysis of Variance (ANOVA) to compare the average of fixation duration between five different product images at the 0.05 significance level. The result of ANOVA indicates that fixation duration of product image with female presenter showing positive emotion is not significantly higher than fixation duration of other four types of product images.

In Table 3, we re-grouped participants into three groups using gender of presenters. The three groups include [2] no human presenter, [1] male presenter, and [3] female presenter. The result shows that product image with female presenter gets the highest average fixation duration and product image with no human presenter gets the lowest average fixation duration. Then, we used Analysis of Variance (ANOVA) to compare the average of fixation duration between three different groups at the 0.05 significance level. The result of ANOVA indicates that fixation duration of product image with female presenter is not significantly higher than fixation duration of other two groups of product images.

Table 3 – Average Fixation Duration: Grouped by Gender of Presenter

<table>
<thead>
<tr>
<th>Product Image</th>
<th>Average Fixation Duration (Second)</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>No human presenter</td>
<td>3.988</td>
<td>2.260</td>
</tr>
<tr>
<td>Male presenter</td>
<td>4.099</td>
<td>2.319</td>
</tr>
<tr>
<td>Female presenter</td>
<td>5.069</td>
<td>3.007</td>
</tr>
</tbody>
</table>

Table 4 – Average Fixation Duration: Grouped by Emotion Expression of Presenter

<table>
<thead>
<tr>
<th>Product Image</th>
<th>Average Fixation Duration (Second)</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>No human presenter</td>
<td>3.988</td>
<td>2.260</td>
</tr>
<tr>
<td>Human presenter with positive emotion.</td>
<td>4.464</td>
<td>3.078</td>
</tr>
<tr>
<td>Human presenter with neutral emotion.</td>
<td>4.704</td>
<td>2.323</td>
</tr>
</tbody>
</table>

In Table 4, we re-grouped participants into three groups using emotion expression of presenter. The three groups are [2] no human presenter, [1] presenter with positive emotion (smiling face), and [3] presenter with neutral emotion. The result shows that product image with human presenter expressing neutral emotion gets the highest average fixation duration and product image with no presenter gets the lowest fixation duration. Then, we used Analysis of Variance (ANOVA) to compare the average of fixation duration between three different groups at the 0.05 significance level. The result of ANOVA indicates that fixation duration of product images with human presenter expressing neutral emotion is not significantly higher than fixation duration of other two groups of product images.
Table 5 – Average Fixation Duration: Grouped by Human Presenter Usage

<table>
<thead>
<tr>
<th>Product Image</th>
<th>Average Fixation Duration (Second)</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>No human presenter</td>
<td>3.988</td>
<td>2.260</td>
</tr>
<tr>
<td>Human presenter</td>
<td>4.584</td>
<td>2.712</td>
</tr>
</tbody>
</table>

As shown in Table 5, product image with human presenter gets higher average fixation duration than product image with no human presenter. Then, we used t-test to compare the average of fixation duration between product image with no human presenter and product image with human presenter at the 0.05 significance level. The result indicates that fixation duration of product image with human presenter is not significantly higher than fixation duration of product image with no human presenter.

DISCUSSION OF RESULTS

In this experimental study, the results from Mirametrix S2 Eye-tracker shows that product image with female presenter expressing positive emotion (smiling face) gets the highest fixation duration, but not significantly higher than fixation duration of other types of product images. When grouping by gender of the presenter, the result suggests that product image with female presenter gets the highest fixation duration. When grouping by emotion expression of presenter, the result indicates that product image with human presenter expressing neutral emotion gets higher average fixation duration then other groups. As shown in Table 2, product image with female presenter expressing positive emotion gets the highest fixation duration, product image with male presenter expressing positive emotion gets the lowest fixation duration. So, the average fixation duration of product images with human presenters expressing positive emotion is less than the average fixation duration of product images with human presenters expressing neutral emotion. And finally, when grouping by human presenter usage, the result suggests that product image with human presenter gets higher fixation duration than product image without human presenter. Results from ANOVA and t-test all indicate that there is no significant differences between different groups of product images. This can be because the product image position on the experiment webpage is in the center of the page and the size of product images are quite large. Hence, participants in the study would look at the product images no matter what types of product images they are. However, most participants suggest in the questionnaire that they prefer product image with female presenter expressing positive emotion (smiling face).

CONCLUSION AND LIMITATIONS

From this study, we can conclude that S2 Eye-tracker and Viewer by Mirametrix can be used for eye-gaze data collection and data collected from the study in CSV document can be analyzed for further statistical conclusion. However, there are some limitations using S2 Eye-tracker for collecting eye-gaze data as follow:

1. We found problems when participants wore eyeglasses. S2 Eye-tracker detected some reflective points of eyeglasses, instead of participants' eyes.

2. We found that sometimes S2 Eye-tracker crashed during collecting eye-gaze data. We suspected that it happened after using S2 Eye-tracker continuously for some period of time. So, we had to find more than 100 participants in order to get usable 100 sets of eye-gaze data.

FUTURE RESEARCH

The results show that five product images are not different significantly. This may be because product image or our area of interest (AOI)'s size is quite large and has its position in the center of the webpage. Most people would look at this product image area no matter what type of product images they are. So, future research can try to change area of interest to other positions of webpage.

ACKNOWLEDGEMENTS

The authors would like to acknowledge the Chulalongkorn Academic Advancement into Its 2nd Century Project for financial support and the Business Visualization Research Group, Chulalongkorn Business School, Chulalongkorn University for supporting of Mirametrix S2 Eye-tracker used in this study. Also, special thanks go to all volunteer participants and all the people who provided supports in this study.

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The Fifteenth International Conference on Electronic Business, Hong Kong, December 6-10, 2015

ARE PEOPLE REALLY CONCERNED ABOUT THEIR PRIVACY?: PRIVACY PARADOX IN MOBILE ENVIRONMENT

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Jae-Hyeon Ahn, KAIST, South Korea, jahn@business.kaist.ac.kr

ABSTRACT
The wide spread of mobile devices enables people to use the Internet everywhere. It provides people convenience in various aspects. However, they also are exposed to the risk of personal information leakage and privacy invasion. No previous study has examined whether the behaviors of people are influenced by their awareness of privacy in a mobile environment. With the ever-increasing importance of privacy issues, our study examines the critical relationship between individual privacy concerns and its behavior. The data is the media diary or 10,174 individuals’ media usage for three days, collected by the Korea Information Society Development Institute (KISDI) in 2014. Our result suggests that privacy concern has a positive influence on the smartphone usage, mobile application purchase and in-app purchase. It implies that the individual privacy concern does not correspond to his or her actual behaviors, which is paradoxical.

Keywords: Privacy Paradox, Privacy Concern, Mobile device, Mobile Environment

INTRODUCTION
With the development of mobile technology and low network charges, many people started to utilize mobile devices such as smartphones and tablets. Among the households in Korea, the penetration rate of smartphone is 84.1% in 2014 [14]. Smartphone usage continues to grow. The average daily usage time of a smartphone is 2 hours 51 minutes in 2014, which is the increase of 38 minutes from a year before. 45.7% of smartphone users spend more than 3 hours with a smartphone [17].

Despite the high penetration and daily usage of mobile devices, people are sensitive to security issues in a mobile environment. Especially, many people are concerned about personal information leakage. According to the Korea Internet & Security Agency, 88.2% of the users recognize personal information leakage and privacy invasion and 85.5% of users concern them as a top priority [15]. Moreover, users’ privacy concern is higher on a mobile environment than on a laptop environment. They are reluctant to do sensitive tasks such as mobile banking or purchasing products because they do not trust security system applied on a mobile [7]. Also, users think that mobile applications require personal information excessively [16]. Privacy issue in a mobile environment has become an important topic in these days.

However, no previous study has examined whether the users’ behaviors are influenced by their awareness of privacy in a mobile environment. We investigate the relationship of individual behavior and privacy concerns in mobile environment and explain the phenomenon. The data used in our research is the media diary or 10,174 individuals’ media usage by every 15 minutes for three days, conducted by Korea Information Society Development Institute (KISDI) in 2014. Our results show that privacy concerns have a positive influence on the smartphone usage, mobile application purchase and in-app purchase. The findings explain the “privacy paradox” that the individual privacy concern does not correspond to his or her actual behavior. In other words, people keep using smart devices and do not demonstrate strong information-protecting behavior, even though they have significant concern on their private information.

RELATEDLITERATURE

Privacy
Privacy is applied to a variety of fields, but there are various definitions without a general consensus. [28] conceptualized privacy with the right to belet alone, limited access to the self, secrecy, control of personal information, personhood, and intimacy. An online environment mainly deals with information privacy and it is one part of whole privacy concept [6]. [26] treated the information privacy as a contrasting concept with the physical privacy which is related with physical access and private space. [30] defined the information privacy as the ability to control personal information individually. [8] also defined it as the claim to protect and control individual data.

Privacy Concern
Privacy concern is the anxiety about the information privacy mentioned above. [27] explained that the privacy concern is associated with collection, errors, unauthorized secondary use, and improper access. This research defines the privacy concern as the degree of personal cares and worries about the possibility of privacy invasion in an online environment [13].

Many researchers used privacy concerns as a dependent variable or an independent variable. [20] explained the privacy-protecting behavior with privacy concern through teenagers’ survey on Internet usage. [25] observed that education level increases privacy concerns through email survey. In addition, a female has higher privacy concerns in SNS and mobile environment and is more willing to do privacy-related behaviors [12][24]. [2] revealed that privacy concern decreases the purchase in an online environment through email survey, [35] demonstrated that privacy concern is mediated by perceived advantage from information exchange and perceived risk from data disclosure through the survey of young adolescents. Prior works examined the difference

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of privacy concern by demographic information or privacy-protecting behavior by privacy concerns. The studies were conducted by survey and these usually studied privacy concerns in online environment. With growing importance of a mobile, we investigate the smartphone usage through the media diary which users filled in their actual use for three days. We examines actual user behaviors with smartphone by privacy concern empirically.

Privacy Paradox
Existing research results presents that privacy concern increases privacy-protecting behavior and people are not willing to provide personal information. However, privacy paradox indicates the counterintuitive phenomenon that the concern or attitude on privacy and the actual behavior are inconsistent [21][22][26]. [29] observed that people provide most of their personal information in online shopping environment even though they have high privacy concern. [21] revealed that people tend to give more personal information in actual behavior than their intention to provide. As people who have privacy concern have high intention to access to new information or service, they tend to provide their information more. This indicates that users can take irrelevant actions on their concern for personal information leakage and privacy invasion, if they find much value on the information or service. Privacy paradox researches have focused on the privacy-protecting behavior and the extent to provide personal information. We extend earlier works on privacy paradox observing actual individual behaviors in mobile environment. Specifically, this work studies the usage of various services in a smartphone based on privacy paradox.

RESEARCH HYPOTHESES
Companies want to increase their value and customer loyalty by providing personalized services. To implement it, they need to use personal information or transactional data. Openness, the unique nature of Internet, enables companies to collect, store and utilize customer’s information easily [22]. As companies analyze the information and select proper target group, they understand more about their customers and provide successful customized services [10]. The recommendation systems of Amazon and Netflix are typical examples. However, information collection of customers causes privacy concerns [4]. When served by these systems, users encounter a difficulty to compromise with their privacy [33]. They have to give up a part of their privacy by providing their information and personal information being stored in servers. Privacy concern has negative influence on the adoption of personalized services [18] and users who have high concern are less inclined to enroll in the web sites [25]. Personal information has a possibility to be traded and used in an unexpected way, and the concern on privacy invasion becomes more significant [24].

As the number of smartphone users increases with the popularity of mobile application, privacy concern in a mobile environment has increased drastically. Even though mobile applications make our lives comfortable and easier with personalized service, they cause anxiety to users [32]. The users are strongly reluctant to provide their contact information to seller in a mobile payment system [11] because privacy assurance is the most influencing factor on the purchase intention for mobile application [23]. In addition, teenagers easily open their and their family information on the Internet in spite of their parents’ worries [5]. Therefore, the following hypotheses regarding privacy concern are proposed.

H1: Privacy concern has a negative influence on the frequency of smartphone usage.
H2: Privacy concern has a negative influence on expense on mobile applications.
H3: People who have high privacy concern are less likely to purchase paid mobile application.
H4: People who have high privacy concern are less likely to make in-app purchase.

METHODOLOGY
Data
The data consist of survey and media diary of 10174 people (4313 households) collected by KISDI in 2014. Survey includes demographic information, possession of electronic devices, and experience of Internet and mobile services. Participants filled in the media diary about the place they used a mobile device and what they did using a mobile device every 15 minutes for 3 day. We excluded people who didn’t answers the items on privacy concern, who don’t use smartphone, and who are under 10 and over 60 years old. After screening out based on the previous criteria, behavioral data of 6817 people are analyzed. Their demographic information is as below (Table 1).
Table 1. Demographic information

<table>
<thead>
<tr>
<th>Item</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>3611</td>
<td>53.0</td>
</tr>
<tr>
<td>Male</td>
<td>3206</td>
<td>47.0</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Under 10</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>10s</td>
<td>1142</td>
<td>16.8</td>
</tr>
<tr>
<td>20s</td>
<td>877</td>
<td>12.9</td>
</tr>
<tr>
<td>30s</td>
<td>1303</td>
<td>19.1</td>
</tr>
<tr>
<td>40s</td>
<td>2031</td>
<td>29.8</td>
</tr>
<tr>
<td>50s</td>
<td>1464</td>
<td>21.5</td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preschool</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Elementary School</td>
<td>341</td>
<td>5.0</td>
</tr>
<tr>
<td>Middle School</td>
<td>610</td>
<td>8.9</td>
</tr>
<tr>
<td>High School</td>
<td>2885</td>
<td>42.3</td>
</tr>
<tr>
<td>College</td>
<td>2853</td>
<td>41.9</td>
</tr>
<tr>
<td>Graduate School</td>
<td>128</td>
<td>1.9</td>
</tr>
<tr>
<td>Monthly Income (Unit: Million Won)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>2981</td>
<td>43.7</td>
</tr>
<tr>
<td>Under 0.5</td>
<td>115</td>
<td>1.7</td>
</tr>
<tr>
<td>0.5 ~ 1</td>
<td>297</td>
<td>4.4</td>
</tr>
<tr>
<td>1 ~ 2</td>
<td>1182</td>
<td>17.3</td>
</tr>
<tr>
<td>2 ~ 3</td>
<td>1126</td>
<td>16.5</td>
</tr>
<tr>
<td>3 ~ 4</td>
<td>655</td>
<td>9.6</td>
</tr>
<tr>
<td>4 ~ 5</td>
<td>282</td>
<td>4.1</td>
</tr>
<tr>
<td>Over 5</td>
<td>179</td>
<td>2.6</td>
</tr>
<tr>
<td>Employment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unemployed</td>
<td>3037</td>
<td>44.6</td>
</tr>
<tr>
<td>Employed</td>
<td>3780</td>
<td>55.4</td>
</tr>
</tbody>
</table>

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>6817</td>
<td>100</td>
</tr>
</tbody>
</table>

Measures
Six items of privacy concern were borrowed from [13]. It consists of Likert five-point scale. With the reliability analysis, Cronbach’s alpha coefficient is 0.949 which is high enough to confirm reliability. All factor loading values are over 0.875, satisfying common standards 0.5 (Table 2).

Table 2. Factor analysis & reliability

<table>
<thead>
<tr>
<th>Item</th>
<th>Content</th>
<th>Factor loading</th>
<th>Reliability</th>
</tr>
</thead>
<tbody>
<tr>
<td>PC 1</td>
<td>Are you concerned about people you do not know obtaining personal information about you from your online activities?</td>
<td>0.894</td>
<td></td>
</tr>
<tr>
<td>PC 2</td>
<td>Are you concerned that information about you could be found on old devices?</td>
<td>0.875</td>
<td>0.949</td>
</tr>
<tr>
<td>PC 3</td>
<td>Are you concerned that you are asked for too much personal information when you register?</td>
<td>0.888</td>
<td></td>
</tr>
<tr>
<td>PC 4</td>
<td>Are you concerned about online identity theft?</td>
<td>0.897</td>
<td></td>
</tr>
<tr>
<td>PC 5</td>
<td>In general, how concerned are you about your privacy while you are using the Internet?</td>
<td>0.917</td>
<td></td>
</tr>
<tr>
<td>PC 6</td>
<td>Are you concerned about people online not being who they say they are?</td>
<td>0.886</td>
<td></td>
</tr>
</tbody>
</table>

To measure the intrinsic influence of privacy concern on smartphone usage, we included control variables which can affect the usage potentially. Gender, age, education, income, employment, and frequency of smartphone usage have influence on the usage of smart device and mobile service [19][31][34][36]. Frequency of smartphone usage is calculated by sum of records to use in media diary and other variables are set by demographic information on survey. To check multi-collinearity, we conducted correlation analysis between variables. Age and monthly income have highest coefficient, 0.452. All other coefficients are less than 0.4, so it is not serious to concern multi-collinearity. In addition, we checked VIF in regression and reconfirmed to exclude multi-collinearity issue (Table 3).
Table 3. Correlation Coefficient

<table>
<thead>
<tr>
<th>PC</th>
<th>AGE</th>
<th>EDU</th>
<th>IC</th>
<th>FSU</th>
<th>EMA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Privacy Concern (PC)</td>
<td>-0.054**</td>
<td>0.188**</td>
<td>0.055**</td>
<td>0.163**</td>
<td>0.097**</td>
</tr>
<tr>
<td>Age (AGE)</td>
<td>0.141**</td>
<td>0.452**</td>
<td>-0.208**</td>
<td>-0.098**</td>
<td></td>
</tr>
<tr>
<td>Education (EDU)</td>
<td></td>
<td>0.313**</td>
<td>0.164**</td>
<td>0.082**</td>
<td></td>
</tr>
<tr>
<td>Monthly Income (IC)</td>
<td></td>
<td></td>
<td>-0.016**</td>
<td>0.016**</td>
<td></td>
</tr>
<tr>
<td>Frequency of Smartphone Usage (FSU)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.235**</td>
</tr>
<tr>
<td>Expense on Mobile Application (EMA)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*p<0.05, **p<0.01

RESULTS

We conducted linear regression analysis and logistic regression analysis to test hypotheses. Table 4 and 5 show the result of linear regression and table 6 shows the result of logistic regression analysis for binary dependent variables. Except hypothesis 1, we added frequency of smartphone usage as control variable to control the potential influence on dependent variables. Hypothesis 1 shows that privacy concern has a positive influence on smartphone usage. This analysis result rejects the hypothesis and shows the opposite direction contrary to our expectation (Table 4).

Table 4. Regression result of hypotheses 1

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Dependent Variable: Frequency of Smartphone Usage</th>
<th>B</th>
<th>S.E.</th>
<th>Std. B</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Privacy Concern</td>
<td></td>
<td>1.795</td>
<td>0.186</td>
<td>0.114</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td>-1.267</td>
<td>0.427</td>
<td>-0.040</td>
<td>.003</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td>-0.284</td>
<td>0.016</td>
<td>-0.247</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td>3.055</td>
<td>0.232</td>
<td>0.163</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Monthly Income</td>
<td></td>
<td>0.631</td>
<td>0.179</td>
<td>0.087</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Employment</td>
<td></td>
<td>-1.146</td>
<td>0.727</td>
<td>-0.036</td>
<td>.115</td>
</tr>
<tr>
<td>Constant</td>
<td></td>
<td>9.047</td>
<td>1.170</td>
<td>-</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

R² = 0.097, Adjusted R² = 0.096, F = 122.068 (p-value < 0.001)

Hypothesis 2 shows that privacy concern has a positive influence on the expense on mobile applications. This analysis result also rejects the hypothesis, and demonstrates the opposite direction (Table 5).

Table 5. Regression result of hypotheses 2

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Dependent Variable: Expense on Mobile Applications</th>
<th>B</th>
<th>S.E.</th>
<th>Std. B</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Privacy Concern</td>
<td></td>
<td>1.295</td>
<td>0.423</td>
<td>0.103</td>
<td>.002</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td>2.179</td>
<td>0.766</td>
<td>0.105</td>
<td>.005</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td>-0.065</td>
<td>0.035</td>
<td>-0.077</td>
<td>.063</td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td>0.672</td>
<td>0.475</td>
<td>0.050</td>
<td>.158</td>
</tr>
<tr>
<td>Monthly Income</td>
<td></td>
<td>0.156</td>
<td>0.331</td>
<td>-0.033</td>
<td>.638</td>
</tr>
<tr>
<td>Employment</td>
<td></td>
<td>-0.200</td>
<td>1.368</td>
<td>0.218</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Frequency of Smartphone usage</td>
<td></td>
<td>0.142</td>
<td>0.023</td>
<td>0.218</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Constant</td>
<td></td>
<td>-4.985</td>
<td>2.581</td>
<td>-</td>
<td>.054</td>
</tr>
</tbody>
</table>

R² = 0.085, Adjusted R² = 0.077, F = 10.996 (p-value < 0.001)

Hypotheses 3 and 4 show that people who have high privacy concern are more likely to purchase paid mobile application and make in-app purchase. This analysis result rejects the hypotheses, too. People use their smartphone and spend money on mobile applications in spite of the privacy concern (Table 6).
Table 6. Regression result of hypotheses 3, 4

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Experience of Paid Mobile App Purchase (H3)</th>
<th>Experience of In-app Purchase (H4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Privacy Concern</td>
<td>1.295</td>
<td>0.423</td>
</tr>
<tr>
<td>Gender</td>
<td>2.179</td>
<td>0.766</td>
</tr>
<tr>
<td>Age</td>
<td>-0.065</td>
<td>0.035</td>
</tr>
<tr>
<td>Education</td>
<td>0.672</td>
<td>0.475</td>
</tr>
<tr>
<td>Monthly Income</td>
<td>0.156</td>
<td>0.331</td>
</tr>
<tr>
<td>Employment</td>
<td>-0.200</td>
<td>1.368</td>
</tr>
<tr>
<td>Frequency of Smartphone usage</td>
<td>0.142</td>
<td>0.023</td>
</tr>
<tr>
<td>Constant</td>
<td>-4.985</td>
<td>2.581</td>
</tr>
</tbody>
</table>

H3: − 2LL = 2354.681, χ² = 191.677 (7 DOF, p < 0.001)
H4: − 2LL = 4185.854, χ² = 80.454 (7 DOF, p < 0.001)

* p<0.05, ** p<0.01

CONCLUSION

This study examined the relationship between privacy concern and individuals’ smartphone usage from the privacy paradox perspective. We formulated hypotheses in a mobile environment and used demographical data to analyze them. The result indicates that four hypotheses about smartphone usage, expense on mobile application, mobile application and in-app purchase experiences were not supported, or confirmed in the other direction. It shows privacy paradox that people do not actually behave reasonably despite their privacy concern.

According to theory of cognitive dissonance [9], individuals seek consistency between their expectations and their reality. Based on the principle, individuals try to protect their information and minimize the usage of service when they worry about privacy invasion. This study represents that we need to examine another facet of individual behavior on privacy. Although most of users know dangers that their information is exposed to others, they do not actually know how dangerous it is or do not care about it. Previous research has shown that individuals carelessly disclose personal information such as a social security number or contact information despite of privacy concern [1]. Also, they do not check how their information is saved and utilized by application developers [3]. Government needs to inform people this situation and suggest a policy to minimize it.

In contrast with the previous studies, we examined the usage on mobile devices empirically by using individual actual data. Previous studies examined individual behaviors on privacy issues through surveys, but we quantified their empirical behavior. Participants recorded their behavior every 15 minutes in media diary. In addition, we extended privacy paradox study by examining details (app purchase, restriction, etc.).

This study has a few limitations. First, we found the privacy paradox in a mobile environment but we do not have the proper explanation why individuals behave in the way we have observed. Further study is warranted to find reasons why. Second, this data includes individual behavior for 3 days. It can be a short period to conclude their behavior. Thus, if we have data which is observed for a longer period of time, we will be able to examine more detailed behavior and perform rich analysis. Lastly, participants record their usages of devices by themselves. It is possible that they do not record them correctly. Collecting objective data is needed in the follow-up study.

REFERENCES

2, pp. 60-67.


BUSINESS MODELS IN E-SPORTS: STARCRAFT 2
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ABSTRACT
E-sports, or electronic sports, is a term referring to competitive (video)gaming, where players face off against each other in serious matches and tournaments. While e-sports have become one of the major forms of digital culture and form of business in gaming, research within e-sports is yet scarce. This exploratory study aims to further the understanding of the business ecosystem surrounding e-sports. We document and investigate different actors, players, their relationship and revenue models in one of the world’s biggest e-sports ecosystems around the game Starcraft 2. We employ the e3-value methodology, along with a qualitative analysis, to build an understanding of the e-sports ecosystem. Through this ecology analysis, five distinct revenue models are identified and the key actors of these are presented. Based on our results, e-sport players employ tournament earnings, casting, coaching, team salary and sponsorships as their main revenue models. Furthermore, the study illustrates the vital importance of sponsors to the ecosystem.

Keywords: E-sports, Business models, Business ecosystems, Gaming, Starcraft 2, e3-value

INTRODUCTION
E-sports, or electronic sports, is a term commonly used to describe games where players face off against each other in serious matches and tournaments. The term can also be written in the form esports. Wagner (2006) builds upon the definition of sport set forth by Tiedeman (2004) and defines esports as:

“eSports “ is an area of sport activities in which people develop and train mental or physical abilities in the use of information and communication technologies.” [35, p.428]

E-sports is an interesting topic, as the e-sports industry is quite new, but growing by a huge percentage each year. The online video-streaming platform Twitch, which hosts many notable e-sport names, had 100 million unique viewers per month during the last year. This signifies a growth of 55 million monthly viewers from the previous year [33]. The International 2014, a major tournament for the game Dota 2, had a prize pool of over $8.7 million [34]. Comparing this to the prize pool the previous year, which was $2.8 million, we can see a significant growth in the prize money awarded [20]. As we can see from these figures, the growth in the e-sports industry during the last years has been dramatic, further cementing it as an interesting subject of study. The three most popular genres among e-sports games are real-time strategy (RTS), first person shooter (FPS) and multiplayer online battle arena (MOBA). The largest RTS game at the moment is Starcraft 2, with Counter-Strike Global Offensive being the most popular FPS game. In the MOBA genre there are several games competing for top position, with Dota 2 and League of Legends (LoL) being the current leaders [24].

Even though the e-sports industry has been growing very rapidly, there has not been much research conducted within the field of e-sports. From the growth of the industry, it is clear that transactions are taking place between network actors on a daily basis, but it is unclear how these actors interact with one another. This subject is not only interesting from an e-sports perspective. It is also of scientific interest to study the development of such a newly formed and rapidly developing business ecosystem. By studying the development of this particular business ecosystem, we might also be able to build a broader understanding of other developing business ecosystems.

The main research question of this study is: “What are the business models e-sports players are using, and how do these business models generate value?”

This exploratory study aims to answer these questions regarding the business models present in the esports ecosystem using the e3-value methodology. This will help build a better understanding of the ecosystem as a whole as well as laying the way for further research on the topic.

DATA AND METHODOLOGY
Netnography and Data Used
The data gathering and first part of the analysis loosely follows a general netnography methodology. Furthermore, the e3-value modelling methodology is used for presenting and discerning the gathered data as well as depicting the ecosystem. Kozinets (2002) describes netnography as a qualitative methodology for investigating social, cultural and economical phenomenon in the online world. The steps of netnography are, in order: research planning, entrée, data collection, analysis and interpretation, ensuring ethical research principles and research representation [13]. The research planning phase clarified the need to find how e-sport players were approaching their trade. This meant finding sources covering the various value generating activities that these players took part in. Due to the fact that the majority of the sources included in this study were of a very public nature, we felt that there was not a need to introduce ourselves to the player community during the process of this study. This is usually the case in netnography in general, as the most common sources for data include Internet forums, web pages, social media as well as chat rooms [13]. The data collection was approached in an iterative way: that is to say that not all sources of

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data were chosen at the start, but rather explored as the research process got further. To help with the analysis of the data, we used the e3-value methodology, as presented in more detail later in this chapter. As mentioned, the nature of much of the data used meant there was no significant need to acquire consent from the writers of the various articles. Likewise, the results of the analysis phase were not directly presented to player representatives, as we felt we had already acquired sufficient knowledge.

Most of the information used in order to identify the actors in the network has been gathered from various Internet sites such as Liquipedia, a Wiki based service focusing on SC2 and e-sports within SC2. Additionally, various articles, data collection sites as well as discussion forums and chat rooms such as IRC and Reddit were used. As e-sports are primarily Internet based, there is an abundance of different information available online. Most of the information comes from websites dedicated to computer gaming, e-sports in general or SC2 in particular. Internet material can in some cases be considered to be less credible than information available in printed form. However, as much of the material collected from various articles and pages available online are read by a large audience, blatant misinformation is often very rapidly exposed by readers who are familiar with the subject. Due to this almost peer review like process; most of the material used is very reliable when it comes to the correctness of the information provided, as faulty information would already have been pointed out. There is, of course, a small chance that some of the information used in this study is incorrect, but as the sources chosen are all of mostly high reputation, the chance for false information is quite low. Kozinets mentions qualities for good sources such as: high traffic, research question relevant segment and descriptively rich data. We feel that the sources used in this study rank highly with regards to these factors, so we feel that we can rely on the information presented by these sources [13].

As mentioned, one of the main sources for information is Liquipedia. The website includes a thorough listing of SC2 teams along with player profiles for individual players. Tournament statistics are also available through the website. As Liquipedia is a Wiki type website, a history section is available for each individual page, showing what revisions has been done and when. This increases the reliability of information, as we can more easily look through the revisions and identify if any false information has been posted intentionally. Another large source of information is the column Insert Coin by Tassi. The column features a series of interviews with influential individuals from different areas of the SC2 professional field [29] [30]. A summary of the sources used in this study, along with the principal type of information obtained from them is presented below in table 1.

<table>
<thead>
<tr>
<th>Source</th>
<th>Source type</th>
<th>Type of information obtained</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liquipedia</td>
<td>Wiki style information portal</td>
<td>Player information, teams, tournaments, broadcasters, sponsorship, general information</td>
</tr>
<tr>
<td>Insert Coin</td>
<td>Column series</td>
<td>Organizations, casting, streaming, general information</td>
</tr>
<tr>
<td>E-sports earnings</td>
<td>Curated information on earnings</td>
<td>Player earnings, tournaments, player information</td>
</tr>
<tr>
<td>#liquipedia</td>
<td>IRC chat channel</td>
<td>Team salary, teams</td>
</tr>
<tr>
<td>Team Liquid Forum</td>
<td>Discussion forum</td>
<td>Teams, player perceptions</td>
</tr>
<tr>
<td>Reddit (/r/starcraft2)</td>
<td>Discussion forum</td>
<td>Coaching, teams</td>
</tr>
<tr>
<td>Reddit (/r/esports)</td>
<td>Discussion forum</td>
<td>Coaching, teams</td>
</tr>
<tr>
<td>Miscellaneous articles</td>
<td>Article</td>
<td>Game developers, general information, broadcasters, viewers</td>
</tr>
</tbody>
</table>

Table 1. Summary of data used

After a significant portion of data was collected, the researchers analysed said data. Rather than strictly coding, the data was mapped to the appropriate e3-value elements, mainly actors and activities.

The categorisation was done according to the researchers best understanding of common themes among the various data sources. Additional data was then gathered to clarify the relationships within the e3-value ecosystem depiction and solidify connections already formed within the e3-value model. This concluded the interpreting part of the netnography research. The details of the e3-value methodology are discussed next.

**The E3-Value Methodology**

The e3-value methodology is a technique developed by Gordijn and Akkermans (2001) for modelling, designing and evaluating business models and economic linkages between different actors within an ecosystem. According to Gordijn and Akkermans, the e3-value method is “based on an economic value-oriented ontology that specifies what an e-business model is made of” [10, p.11](Gordijn, Akkermans 2001m pp. 11). For this study the e3-value methodology gives a clear tool with which to map the collected data into an easier to understand form. The mapped data helps clarify how the various business models are situated in regard to each other. Previously the e3-value methodology has been used to model for example strategic partnerships and e-services [4].
A graphical representation tool accompanies the e3-value methodology. The symbols used in this tool, along with descriptions of what these symbols represent, are presented above in figure 1.

An actor, according to Gordijn and Akkermans, “an independent economic (and often legal) entity” [10, p.13]. A market segment is a piece of the overall market that consists of individual actors that can be grouped together based on common characteristics. The third main element of the model is the value activity, which is a certain task or activity that an actor performs. The goal of the value activity is often to generate revenue, but there can also be other motives associated with it. A composite actor is a group of individual actors forming together in order to provide a specific product or service. Value objects can be both material and immaterial things exchanged between actors in what is termed a value exchange, and they are exchanged through value ports. A value offering is, as the name suggests, an offering between two distinct value objects, usually linking value ports together. Value interfaces group these value ports, as one actor might exchange value produced by a single value activity with many separate other actors or market segments. [10]

In the e3-value model, a distinct start and end stimulus can usually be defined. The start stimulus has its point of origin in a specific need, for example the need for getting coached by a professional player. The stimulus can go through the value network in complex ways, but it comes to an end point at the producer of the service or physical item, in this example the end point is at the professional player who provides the coaching. [10]

This paper implements the e3-value methodology to map the different actors and market segments associated with the SC2 e-sports field. By mapping these, we can build a better understanding as to what kind of networks exist, and through these identify the revenue models present.

**NETWORK ACTORS IN THE E-SPORTS BUSINESS ECOSYSTEM**

In this chapter we examine the different actors in the e-sports ecosystem based on our observations. The intent is not only to describe the various actors but also their position in relation to each other. For each network actor the following information will be presented: who they are (the actor), what they do (the actor’s value propositions) and why they do what they do (the business model). The actors that were chosen for this study were the ones most frequently mentioned during the data collection phase. These different actors appear to be of significance within the e-sports cultural community, and hence can be seen as central to the ecosystem.

**Professional Players**

One dictionary definition of professional is “participating for gain or livelihood in an activity or field of endeavour often engaged in by amateurs” [22]. The definition of what a professional player in e-sports is can be a bit more difficult, as the line is not always as clear as in for example traditional sports. Not everyone who is considered a professional player lives solely on playing, and might have other means of income such as a day job. It is worth noting that not all activities that professional players earn income from are strictly based on playing. These other sources of income are talked about in more detail later in the study. We have chosen to classify players as professional players and other players as we feel this best represents the multifaceted roles of players. An alternative classification would be to group players as professionals, semi-professionals, amateurs and casual players.

Professional players emerge from the general player population due to the competitive environment that the e-sports field creates. Most of the games played in high level e-sports play are very skill intensive and require a large commitment of time to practice in order to excel. Not all players have the opportunities and capacities, or the desire, to become professional players. This is further discussed in the section about other players.

An example of a professional player would be Yo-Hwan Lim, more commonly known by his in-game name “BoxeR”. Lim is one of the most known SC2 players in South Korea, having a fan club of over 600 000 people. Additionally, Lim has released...
a DVD containing some of his most well known matches, and written an autobiography titled “Crazy as Me”. Lim started his career in 1999 and was most successful in the first half of the 2000’s. He is not currently one of top players, but is still regarded very highly within the player community. Lim received a personal sponsorship of approximately $180 000 from Intel at the end of 2010, solidifying his position as a notable person within the e-sports field. As can be seen in this example, the way in which a professional player generates revenue can be done in several different ways, with revenue coming in from several different actors and market segments. [14]

**Sponsors**

Companies or organizations can choose to sponsor either individual players or whole teams. The majority of sponsors are commercial actors and companies. The most common sponsors are manufacturers and sellers of gaming equipment, consumer goods such as beverages as well as general computer equipment and components.

Sponsoring within e-sports can be seen as the same as any kind of other commercial endorsement and parallels can be drawn to sports endorsement, which is frequently used within other fields of business [28]. Players and teams offer the same kind of visibility that for example football players and teams offer to their respective sponsors, the only notable difference being that the target audience is smaller and more specific. One could argue that sponsoring within e-sports is more effective than sponsoring in the traditional world of sports, as the target audience is much narrower, so it can be more resource efficient for a sponsor to get the desired message across.

An example of a big sponsor in the e-sports industry would be the South Korean conglomerate Samsung. From the year 2000 onwards, Samsung was the sponsor of one of the largest e-sports tournaments in the world, the World Cyber Games (WCG). The partnership was a very visible one, with Samsung’s logo showing on the front page of the WCG website and Samsung being involved with several aspects of the event. The WCG as an event was disbanded in 2014. [37]

**Teams**

Teams, sometimes called clans, can play a very varied role within e-sports, and there are as of yet no set definitions as to what type of teams there are. However, by looking at the different teams operating in the e-sports field, we can identify different kinds of teams based on their organizational structure. Teams can be separated into two categories: “one game teams” and “multigame teams”. As the name suggests, one game teams focus on only one particular game title, whereas multigame teams can have players playing several distinct game titles. One view on this is that multigame teams are more about using the team as purely a brand, where as one game teams are more tightly focused on building up the skill of the individual players by practicing only against the other skilled players in the team. An example of a one game team is “SK Telecom T1”. Examples of multigame teams are “Evil Geniuses”, “Team Liquid” and “Invictus Gaming”. There has been a noticeable shift in recent years from one game teams towards multigame teams among professional teams in the western hemisphere. In Korea, it appears that one game teams have remained more important, possibly due to the larger scale of the general ecosystem surrounding SC2. [15][18][19]

In SC2 most teams are one game teams formed of individual players, with the intention to promote the team as a whole, even though most games are played on an individual basis. Because competitive SC2 is almost solely based on individual games, the function of a team is not the same as in more traditional sports such as football where each member of a team contributes in his or her own way to the overall success of the team. In SC2 members of the same team can very well be pitted against each other in tournament matches. Here we see perhaps the biggest difference between SC2 and other popular e-sports games, as LoL is a team-based game, thus meaning the team has a very different role for the players.

An example of a well-known team within the e-sports field would be Evil Geniuses (EG). EG is a multigame team, with their team roster consisting of the following games: Starcraft 2, Dota 2, Super Street Fighter 4, Marvel vs Capcom 3, Heroes of the Storm and Halo. EG has backing from large sponsors such as Razer (gaming paraphernalia), Kingston (computer components) and Monster Energy (beverages). The SC2 division of the team currently has six players representing four different nationalities, with most of the players from North America. [8][15][18][19]

**Tournament Organizers**

The tournament organizers are the people, organizations or companies responsible for making a tournament happen. Tournaments can take place online as well as in a physical location. It is common to organize the biggest and most important tournaments in a physical location, as these tournaments gather large crowds that are interested in seeing their favourite players play SC2.

The smallest types of tournaments are informal get-togethers built within a specific community, which might be a group of friends who all know each other, or the users of an online discussion forum. These tournaments might not have any prizes, and are mostly played as a recreational activity. On the other end of the spectrum we have highly competitive tournaments and tournament series organized by commercial tournament organizers, such as the GOMTV Global Starcraft 2 League (GSL) in South Korea and Major League Gaming (MLG) in the United States. This study will concentrate more closely on the top end of tournament organizers, due to this study having its central focus on business models present within the field of professional e-sports players.
An example of a well-known tournament organizer is the previously mentioned Major League Gaming (MLG), which operates in the United States. MLG was founded in 2002 and is currently one of the biggest e-sports leagues in the western hemisphere. During 2011 MLG organized six Pro Circuit events in different parts of the US. The events feature a main SC2 tournament along with tournaments for two other games, Halo: Reach and Call of Duty: Black Ops. Along with the Pro Circuit series MLG also organizes regional Invitational tournaments for Europe, Asia and the US leading up to the MLG Global Invitational Finals. The Pro Circuit tournaments offer a prize pool of $14 000. It is worth to note that the prize pool for the South Korean GSL tournaments is considerably higher, showing the geographical differentiation discussed by Rosenqvist and Wright. [17] [21] [27]

**Broadcasters**

We can identify two distinct types of broadcasters operating within the SC2 e-sports field. The value these two types produce is quite similar, but it is still important to make a distinction between them.

The first type of broadcaster is the individual broadcaster. This person is usually also a professional player, but it is important to make a distinction between these two, as these are two distinct sources of income for the individual. The most common type of individual broadcasting activity is streaming practice games. This activity is usually coupled with the practice of casting, creating both visual and audible value for the viewer.

The second type of broadcaster is the organizational broadcaster, which can be either a commercial broadcaster or a player driven communal broadcaster. Both of these operate in a similar fashion, with a certain fixed staff and alternating visitors doing casting. These also commonly operate as streams, but televised broadcasting is also common in for example South Korea [36]. We can naturally differentiate between these two subtypes of organizational broadcaster, as commercial broadcasters have the objective of making money for their stakeholders, whereas player driven communal broadcasters generate social value rather than monetary value.

An example of a well-known individual broadcaster is Steven Bonell II, more commonly known by his screen name “Destiny”. Bonell II is an active SC2 player, and more importantly, a very active streamer. Most of the streaming content shows practice games being played against other players, along with running commentary on the games. Aside from practice games, Bonell II also streams more competitive games and games put on solely as a show. [2][31]

**Other Players**

The professional players make up only a small percentage of the total player population within the SC2 community. Most players are non-professional players that play only for their own entertainment, as a hobby, rather than the game also being a source of revenue. Some of the players are content playing the game on a more casual level, where as part of the players would like to successful on higher levels of the game. These are the aspiring players, and they are very important for the e-sports industry growth as they are watch streams, compete in tournaments and follow professional players very closely. The second kind of other players that are presented in this study is what can be called the audience.

Being that the objective of these aspiring players is to become professional players, there are several ways to achieve this. The route most players take is to simply play more and use more time on practicing. The second option, which is getting increasingly more available, is education within the subject. Many professional players offer coaching services, usually for an hourly rate. The goal of this coaching activity is to transfer knowledge from the professional player to the aspiring player. Aside from this direct coaching, there are also many websites dedicated to articles and discussion about SC2 strategy and theory. The University of Berkeley has taken this one step further, as it has run a course on SC2 theory in the past, based on a student initiative [1].

The audience, or viewers, follows streams and tournament results, but might not be interested in taking part in high-level competitive play themselves. Among members of the audience, there are also people who do not play SC2 at all themselves, but still enjoy watching competitive matches.

**Game Developers**

There would naturally be no e-sports business without games to play, so game developers play a big role in shaping the e-sports business. Due to the fact that e-sports are centred on individual game titles, the dynamics of the field is quite different from traditional sports. Where traditional sports such as football and basketball have evolved over a period of years into mostly independent institutions, esports is ever changing, as game developers release new games and old games get left behind. This means that game developers play a crucial role in shaping how the e-sports field looks. Customer needs naturally indicate in what kind of direction the game industry moves, as game developers aim to please their customers.

As the rules and inner workings of computer games are not as rigid as in traditional sports, changes can be made very dynamically and implemented almost instantly. Blizzard Entertainment, the developer of SC2, takes a very active role in balancing the game mechanics by changing individual aspects of the game if any strategies are seen as overwhelmingly powerful [3]. This means that players need to learn how to adapt to changes in the game. This is quite different from traditional
sports, where the athletes know that the rules of the game are not going to drastically change, and can concentrate on specific aspects. This also means that professional e-sports players have to develop a more general skillset that can work in different situations, as well as different games if the ecosystem changes significantly.

As this study mainly focuses on SC2, it is naturally interesting to look at how the game’s developer, Blizzard Entertainment, is involved in the e-sports business centred around this game. Blizzard Entertainment is not as closely involved in the e-sports business as some other game developers are in their respective fields. For example, Riot Games, the developer of League of Legends, is extremely involved in the e-sports aspect of League of Legends.

**REVENUE MODELS**

In this section, the central traits of each of the identified business models will be listed, a real world example of such an actor will be given and finally the value proposition in the business model will be described, with information on where the revenue streams come from. Furthermore, figure 2 contains a graphical illustration of the ecosystem as depicted by the e3-value methodology.

**Tournament Earnings**

One of the main sources of income for most players is prize money that can be won by playing and participating in tournaments. Tournaments range from huge production played at a physical location to smaller tournaments held online. Tournament prizes are usually awarded as money, but product prizes also exist. Tournaments awarding product prizes are naturally tempting for companies, as they offer easy access to a large target audience with quite a minimal investment in the form of products the company produces.

The widely influential SC2 information portal Liquipedia categorizes tournaments into various different categories based on regularity, amount of players, prestige, prize pool and several other factors. There are naturally several ways to categorize tournaments, and the model used by Liquipedia is only presented here as an example. These event categories are: Premier, Major, Team, Monthly, Weekly, Show Matches and Miscellaneous. The 2014 Premier Event schedule included 36 tournaments with average number of players being 49. The combined prize pool of these tournaments totalled $2,547,969, with an average prize pool of $70,865 and prize pools ranging from $18,500 to $250,000. [15][18][19]

An example of a widely successful tournament player would be Jang Min Chul, better known by his player name “MC”. E-sports Earnings report his lifetime tournament earnings to be $490,722. He has several first place finishes to his name from some of the most prestigious tournaments and leagues organized, such as the IEM 4 World Championships. It is worth noting that most of the players with high-level tournament earnings are from South Korea, as many western players do not have access to the same tournaments as players in South Korea. [5]

The value offering of this revenue model is that the professional player brings a certain level of recognition for the tournament he or she is playing in. The tournament organizer is willing to offer prize money for the best finishers at tournaments as a value exchange. The tournament organizer mainly generates income via sponsorships and ticket sales for spectators. Hence the actor or market segment that actually pays for this are the sponsors and people who show up at these live tournaments and pay an entrance fee. This situation can be seen as a two-sided market; a situation where there are two separate actors that each has its own needs that need to be pleased [26]. The tournament organizers generally need both sponsors and players, and one is dependent on the other. If the level of play is not high enough, sponsors will be discouraged to pay for the visibility and likewise if there is not a notable amount of prize money on the line, players might not want to participate.

**Casting**

Casting is the act of commenting competitive games, either live or pre-recorded. The similarities and ties to broadcasting are apparent, as most of the broadcasted games in e-sports have some form of casting. The activity and processes behind it also share many similarities with casting and commenting in traditional sports.

An example of a player involved in casting is Steven Bonell II, who was discussed earlier in the section on broadcasters. As mentioned, Bonell II streams his live games to a large audience. Bonell II has estimated that he makes an average of $2 per two thousand viewers per commercial shown in the stream. Assuming an average audience of four thousand viewers, showing eight commercials during the period of an hour would total an income of $32 per hour. [2]

The value offering can take several forms. If the player has a personal stream, the value provided for the viewer is a combination of entertainment and knowledge transfer. If the player is casting for a broadcaster, the value provided is providing an expert view on the games, sharing the knowledge that the player has. In this revenue model the revenue is generated from both individual viewers, some of which might pay a fee for a higher quality service such as Twitch.tv provides, as well as sponsors and advertisers that show product promotions during the streams. [32]

**Coaching**

Some professional players offer their services as coaches for other players as a way to form a new revenue stream. Most coaching is done as one off deals, and usually at a per hour rate. The average hourly rate for the players offering coaching at
the biggest coaching site GosuCoaching was $67, with individual rates ranging from $20 to $300 [11].

An example of a player well known for his coaching activities is Geoff Robinson, better known by his screen name “iNcontroL”. Robinson is one of the founders of the GosuCoaching website, and lists an hourly rate of $80 for coaching. Even though some of the other players charge higher prices per hour, Robinson is considered one of the most well known coaches in the SC2 e-sports field.[2] [11] [16]

The professional player provides insight and helps the player buying the service to improve his or her play skills. The value activity involves a kind of knowledge transfer. The revenue generated in this revenue model comes from the individual actors buying the coaching services from the professional players.

Teams
Players belonging to a team are usually paid a form of team salary. The nature of this salary can vary from team to team, ranging from a monthly salary to one off payments to cover tournament travel expenses. Aside from a strictly monetary salary some teams may also pay the players’ living expenses. In these cases it is common for all the players to live at the same location, in so called team houses, in order to be able to train effectively [7]. Very little data is available on team salaries, as most teams keep the specifics a secret [9].

An example of a well-known player who earns top salary in SC2 is Kim Won Ki, better known by his screen name “FruitDealer”. Won Ki plays for the South Korean Team SCV Life (TSL). He is reported to earn a yearly salary of 35 000 000 KRW, roughly $31 000 [23]. There are players who likely receive higher salaries than Won Ki in other teams.

The value offering of this revenue model is that the player provides an important asset for the team. The team needs high quality players to increase public visibility as well as help improve the overall skill level as the players in the team play against a team. A higher overall skill level means that the team is likely to have higher success at tournaments, leading to a larger interest from sponsors. The revenue generated in this business model comes from the teams, who pay the players some kind of monthly or yearly salary. As previously mentioned, there are several different ways of operating teams, and as information is not easy to find on the subject, it is difficult to give any definite answer as to how much or in what way players actually receive payment from the team. However, the specifics of who earns what are not essential for this study, as we are not as concerned with quantifying the business models.

Sponsoring
Even though most commercial sponsorship within e-sports is directed towards leagues, tournaments and teams, there is still a level of personal sponsorship for some players. Much in the same way as with teams, players can receive either money or other goods from sponsors.

An example of a professional player who has a large personal sponsorship contract is Yo-Hwan Lim, who was already mentioned earlier in the section about professional players. As stated, Lim signed a $180 000 contract with Intel at the end of 2010, one of the biggest individual sponsorships in SC2 esports history [14].

The value offering in this revenue model is that the player creates visibility for the sponsor within the e-sports world. Many of the high level players have a large fan following, creating a lot of visibility for potential sponsorship partners. The revenue generated in this revenue model comes directly from the sponsoring company. The contract can supply the player with a monthly or yearly income, but the sponsorship deal might also be a one-time transaction, where the player receives payment at the beginning of the contract period and obliges to follow the contract for a set period of time.
Figure 2. The SC2 value network, from the perspective of a professional player.
CONCLUSIONS

Summary
This study identified the essential actors present in the e-sports ecosystem centered around Starcraft 2, with the main focus being on the professional players. By looking at the ecosystem and the actors present, five revenue models for professional players were identified. As a quick reference, the revenue models identified along with who the customers are and where the revenue comes from is presented in table 2 below.

<table>
<thead>
<tr>
<th>Value activity</th>
<th>Consumer</th>
<th>Revenue from</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tournament playing</td>
<td>Audience</td>
<td>Tournament organizers &amp; Viewers</td>
</tr>
<tr>
<td>Coaching</td>
<td>Other players</td>
<td>Other players</td>
</tr>
<tr>
<td>Casting</td>
<td>Audience</td>
<td>Sponsors &amp; Viewers (premium fees)</td>
</tr>
<tr>
<td>Team salary</td>
<td>Teams</td>
<td>Team (through sponsors)</td>
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<td>Sponsorship</td>
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Sponsors are responsible for the revenue streams in three revenue models: casting, team salary and sponsorship. The audience can also be seen to be an important market segment, as it is the consumer of many of the services that the professional player produces. The main conclusions that we can draw from this study is that sponsors are vital for the continuance of e-sports. If all revenue coming from sponsors would disappear, it is doubtful that e-sports would continue in the same form, as it exists today. Without sponsors, a shift toward paying for watching streams and tournament matches would be required to keep the tournament circuit running. Comparing the situation to traditional sports, we can see that sponsorship is of importance in both traditional sports and e-sports. The culture of paying to watch games either live or broadcasted is not yet as established in e-sports as in traditional sports. However, a recent study suggests that e-sports viewers are willing to spend a significant amount on tickets for events, and also want more events to attend[6].

It seems as if many professional players have already realized that they can receive revenue streams from several different sources, and it also seems that many players have found utilizing these different streams to be quite easy, as there are many players serving many different roles within the ecosystem.

Industry Implications
As mentioned, sponsors are one of the central actors in the ecosystem, as much of the actual revenue comes from them. This is something that professional players as well as other actors in the e-sports field should take into consideration when thinking about their own revenue models. In order to increase financial stability a professional player might want to diversify his or her revenue streams as not to be dependent on a single actor or market segment. By identifying the different sources of revenue streams the individual professional player can choose to concentrate his or her efforts towards serving sources of revenue that depend on different actors and market segments, thus lowering the risk of being completely without a source of revenue even if one source would disappear.

The relationships between the different actors are of relevance, something worth noting for other actors than just professional players. All actors that conduct business within the e-sports industry should have an interest in making their own efforts more effective, increasing revenues and decreasing costs. The ecosystem is a good place to look for opportunities to build synergies with other actors.

Research Implications and Suggestions
Building on this study, it might be of interest to further study the relationships between the various actors and how they interact with each other. Within this, the knowledge transfer between coach and coached player might be of particular interest. A quantitative study into how these different revenue models measure up against each other might also be of interest, especially if the e-sport industry continues to grow as rapidly as it has during the last years. At the moment, acquiring the detailed information for such a quantitative study has been a challenge, as many players and other actors are guarded towards releasing financial details.

Another topic that could need further investigation is what makes a game a successful e-sport, as not all games are adopted as tournament games in the e-sports field, only a few select games rise to the top and become lasting hits with an ecosystem built around them. This subject is also linked to what the end consumers find interesting and exciting. Not very much is known about the spectator experience within e-sports, as the industry is quite new. Finally, the geographical difference mentioned by...
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The Fifteenth International Conference on Electronic Business, Hong Kong, December 6-10, 2015


CHINESE-STYLE OF REWARD-BASED CROWD-FUNDING: FINANCIAL APPROACHES OR MARKETING TOOLS?
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ABSTRACT
Crowd-funding is an emerging industry in China. However, Chinese crowd-funding market has some different characteristics to its US-based or Europe-based predecessors. Some of Chinese founders regard reward-based crowd-funding as a funding approach, while others highlight its marketing functions. Thus, which play more important role at present? This paper investigates the reason for the special performance of reward-based crowd-funding in China from multiple perspectives. The results indicate that the special institutional environments of China—lack of perfect social credit systems and legal systems, not granting legal definition and status for crowd-funding, leads to an inevitable result that Chinese founders make heavy use of the marketing functions of crowd-funding but make light use of the funding function at the present stage. With the perfecting of the institutional and legal environment, many small-and-medium-enterprises and individual entrepreneurs are expected to pay more attention on the funding function of crowd-funding than today.

Keywords: Reward-based crowd-funding, institutional environment, legal fundraising, pre-selling

INTRODUCTION
Recently, crowd-funding is quickly becoming one of the most fashionable words and a novel Internet-based finance mode throughout the world. One of main reasons for the explosive growth of crowd-funding industry may be due to its providing of a new viable option for entrepreneurial and small business to raise money from the crowd. That is, crowd-funding is a low cost and open source of capital to the small and growing businesses by allowing them to leverage the power of the Internet and online social media. According to [23], more than 30% of all small and growing businesses in the world (the percentage may be much higher in some developing countries or countries with strict financial controls, such as in China) are facing the difficulty to access finance under traditional financial systems such as banks and venture capitalists (VCs). Therefore, when crowd-funding presents its powerful financing function, hundreds of thousands of entrepreneurs are attracted and flooding into this emerging field.

The term “Crowd-funding” was coined by Michael Sullivan back in 2006 with the launch of fundavlog, a failed video-blog-related website including a simple funding functionality. However, the mass usage of the term crowd-funding became available a few years later with the advent and success of the platform Kickstarter since 2009. Thus, as an evaluating concept, there is not a popular and academic definition for crowd-funding by far. Some scholars defined crowd-funding from a perspective of Internet-based finance (i.e.,[18][19]), and some others draws inspiration from concept of “crowd-sourcing” (i.e., [3][12]); nevertheless, most extant definitions of crowd-funding highlight the financing function for entrepreneurial individuals and groups. Some studies also shed light on the marketing purposes of crowd-funding for innovative products or services which are in the early stages of development (i.e.,[18][19]). Additionally, for the crowd-funding industry itself, new patterns or systems are being created one after another. At the time of this writing, there are four main settings in which individuals can fund projects [18]: reward-based, equity-based, loan-based, and donation crowd-funding. This study focuses on reward-based crowd-funding, in which funders receive a non-monetary reward for backing a project [18].

Crowd-Funding in China
Compared with the prosperity of crowd-funding systems in North America and Europe since 2009, it’s a little late for China to enter the crowd-funding market, as Chinese first crowd-funding platform “Demohour” launched in May 2011. It’s a Kickstarter-like reward-based crowd-funding site and opening to several types of projects such as design, technology, music, cinema, games, etc. Some projects in Demohour had raised over ¥ 1 million (about, $170,000), for example, a smart Wi-Fi plus socket called Smart Plug successfully solicited 3,754 backers with total funds at ¥ 1.7 million (about, $280,000); and the animated film One Hundred Thousand Bad Jokes raised ¥ 1.37 million (about, $200,000) from 5,534 investors. It looks like a successful crowd-funding platform; however, it’s transforming itself into an intellectual hardware-related e-commerce website rather than a pure crowd-funding intermediary. To some extent, it might be concluded that a Kickstarter or Indiegogo-like crowd-funding platform is difficult to achieve success in China. Nevertheless, Demohour seems a spark of China’s crowd-funding, dozens of crowd-funding websites emerging since its launch in 2011.

In line with [11], China had more than 110 crowd-funding platforms (excluding those for nonprofits) as of the end of 2014, up from 78 a year ago; 75 of the exerting sites are reward-based and 27 of them are equity-based. Among them, Taobao Crowd-funding and JD Crowd-funding are established by Taobao and JD, who are the two largest e-commerce companies in China, respectively. A total of ¥ 915 million (about $148 million) was raised through crowd-funding sites in 2014, ¥ 440 million (about $71 million ) derived from reward-based projects. Certainly, $71 million is really a pretty small number in the
huge market (i.e., Kickstarter’s volume in 2014 reached more than $444 million), but the fantastic growth rate is notable that the funding volume of Chinese reward-based projects had reached ¥800 (about $130 million) only in the first half of 2015.

At present, most reward-based crowd-funding sites look like Kickstarter or Indiegogo, however, they have different envisions. For instance, both Kickstarter and Indiegogo highlight their role as financing approaches. Specifically, Kickstarter declares that it’s a new way to fund creative projects; while Indiegogo is the way ideas get funded and realized across the globe. By contrary, many Chinese project founders use crowd-funding for marketing. In other words, if we accept that the “Crowd” and the “Funding” are two essential elements in defining crowd-funding as an activity, the entrepreneurs in the U.S. prefer the “Funding” function, while the Chinese entrepreneurs tend to gather the “Crowd”. In terms of the Chinese-style reward-based crowd-funding, there’s a prime example features Feng Wang, a very famous Chinese rock star, who pledged a campaign in July 2014 for his upcoming Beijing concert. His funding goal was a very low number---¥3,000 (less than, $500), it is clear that the rock star had greater goals (i.e., to advertise his concert) than funding, albeit his project got successful fundraised with the actual amount of money raised almost ¥30,000 (about $5,000), ten times higher than the funding goal. Additionally, large numbers of Chinese scholars and entrepreneurs argue that crowd-funding is a novel pre-selling channel rather than a financing approach, although they admit the strong financing function of crowd-funding for entrepreneurial and small businesses. That is, to some extent, the foundation of crowd-funding----soliciting funds from the individuals to support founder’s entrepreneurial ideal, is weakened in China. Therefore, we question: Is this a rational and transformational trajectory for crowd-funding in China? In terms of the two elements “Crowd” and “Funding” in reward-based crowd-funding, which is more important for Chinese crowd-founders: as a financing approach to gather funds or as a marketing tool to gather the potential consumers?

Crowd-Funding is not the Solely IT-Related Thing Coming From Abroad
Crowd-funding is not the first IT-artifact that coming from outside of China, some other Internet-based business models or applications such as e-commerce and social network service (SNS) are not original. However, nearly all of the Internet-based products, which were derived from advanced economies, experienced hard processes to survive and develop in Chinese market. In the case of e-commerce, TaoBao (www.taobao.com), launched in 2003, is the largest and most successful e-commerce platform in China by far. In fact, TaoBao is an imitator of eBay (www.ebay.com), which launched in 1995 and was a US-based pioneer of e-commerce in the world. eBay entered China in 2003, when TaoBao was in its infancy, and directly copied its formula from the United States such as charging multiple fees from sellers, credit-card-based Paypal payment systems, and so on. However, when the first online sellers were facing difficulties to earn money from the early bird in Chinese e-market, eBay’s charge-strategy came into being a large barrier. Thus, most sellers of eBay were attracted and migrated to TaoBao when the newly launched website declared a strategy of free-of-charge in 2003. Furthermore, Paypal was destined to fail in China, because China’s lack of personal credit systems made the credit-card-based person-to-person payment system being impracticable.

As a result, just three years after, eBay was defeated by its imitator TaoBao and pulled out of China in 2006. Many scholars explored the reasons of eBay’s failure in Chinese market and revealed that the poor localization strategy, lack of cultural sensitivity, and the incompatibility of institutional environment were significant influencing factors (i.e., [10] [15] [20] and [24]). Similar situations and conclusions could be used to analyze the failure of MSN Messenger, Google, and many other IT artifacts in China in recent years [15].

On the contrary, the success of TaoBao in China mainly due to it has a deep understanding of the culture and institution what enables it to provide correct response in the indigenous market. For example, TaoBao provided free-of-charge platform for users to help them benefits from selling online in the early days; it provides an instant messaging system (namely, AliWangWang) to help developing swift guanxi ([20][21]) between buyers and sellers; and the most important strategy is that it successfully developed an amazing third party payment system, Alipay, which provides escrow between the buyer and the seller.

It should be mentioned that e-commerce, as an exotic IT-artifact, is modified significantly by Chinese culture, policies, and institutional environment, etc. Similarly, crowd-funding systems may need to be acclimatized to the China-based unique cultural, political, and institutional environments.

POSITIVE 1: CROWDFUNDING IS BECOMING A GLOBAL PHENOMENON
Crowd-funding is becoming a global phenomenon. The advanced Internet technologies and mature social network services fertilize the online crowd-funding industry. According to [16], in 2014 global crowd-funding experienced astounding growth and the volume had reached $16.2 billion with a 167% up from $6.1 billion in 2013; furthermore, the crowd-funding volume is expected to be climbing to $34.4 billion in 2015. The accelerated growth in 2014 was due in part to the rise of Asia as a major crowd-funding region with a fabulous growth rate 320% and a raised volume $3.2 billion (being the second-biggest region by crowd-funding volume, compared with $9.46 billion in North America and $3.26 billion in Europe). Among the figure, Chinese crowd-funding market made a substantial contribution.

Theoretically, other than the traditionally-funded project, which is often highly constrained by geography [5], Internet-based crowd-funding systems have the potential to mitigate the distance effects [1], everyone who want to participate crowd-funding
projects could be involved in. An amazing but not a unique example occurred in 2014, when “Sociedad Deportiva Eibar”, a Spanish football team, successful fund-raised €1.98 million from more than 8000 fans from 48 countries including more than 300 Chinese fans. That is, crowd-funding is an excellent funding approach without national boundaries. Therefore, crowd-funding will open a new window for the large number of Chinese Small and Medium Enterprises (SMEs) and start-ups who are facing increasingly difficulties to obtain necessary capital from banks or other traditional financial systems because of strict financial regulations and restrictions.

According to the statistic of China Association of Small and Medium Enterprises (CASME) (2015), China has more than 10 million SMEs by far, which contribute to more than 60% of Chinese Gross Domestic Product (GDP), more than 50% of internal revenue, and create more than 80% employment positions for urban people. In addition, China also has a large number of individual entrepreneurs who contribute to national economy. Therefore, China is a potential huge crowd-funding market, like the prediction of [23] that Chinese crowd-funding volume could grow to $50 billion in the next decade.

Furthermore, from a perspective of academic research, some scholars also indicated that crowd-funding projects could solicit distant contributors via the Internet. For example, the study of [1] draw on a dataset from Sellaband, a Germany-based musical crowd-funding intermediary, examined the geographic decentralization of funders and found some evidence that crowd-funding relaxes geographic constraints among funders. Similarly, based on the data from Kickstarter, [13] investigated the effect of geography on crowd-funding, the findings revealed that technology-related projects tend to attract a vast majority of funds outside of their home regions. Another study conducted by Althoff & Leskovec in 2015 [2] also provided evidence that both local and distant backers contributed to school-related projects via DonorsChoose.org, and distant backers were found to be with high loyalty. Certainly, there’re also inconsistent findings. For instance, the study [4] analyzed the data of Kiva and revealed that crowd-funding websites could not eliminate the effects of geography and cultures; they indicated that funders still prefer culturally similar and geographically proximate entrepreneurs. The findings approximated the results of [8], in which the negative effects of distance on online transactions were revealed; meanwhile, culture was regarded as one key influencing factor that leads to the geographic biases of trade online.

Increasingly scholars are being attracted by the novel crowd-funding modes and being dedicate to relevant research work. However, most extant research on crowd-funding employed US-based or Europe-based examples/dataset (see, Table 1), which may not be fully applicable to China because of different economical, cultural, or institutional environments between China and Western countries. Hence, we will discuss some unique features of crowd-funding in China in the following section.

<table>
<thead>
<tr>
<th>Topic</th>
<th>Data Source</th>
<th>Location of Data Source</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dynamics of crowd-funding</td>
<td>Kickstarter</td>
<td>The United States</td>
<td>[16]</td>
</tr>
<tr>
<td>Influence of offline social relation and distance on crowd-funding</td>
<td>Sellaband</td>
<td>Germany</td>
<td>[1]</td>
</tr>
<tr>
<td>Influence of internal social capital on crowd-funding</td>
<td>Kickstarter</td>
<td>The United States</td>
<td>[6]</td>
</tr>
<tr>
<td>Influence of social capital on crowd-funding in cross-cultural context</td>
<td>Kickstarter / Demohour</td>
<td>The United States / China</td>
<td>[22]</td>
</tr>
<tr>
<td>Antecedents of Crowd-funding Project Success</td>
<td>Demohour</td>
<td>China</td>
<td>[9]</td>
</tr>
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<td>Effect of founder’s completing bias on crowd-funding</td>
<td>DonorsChoose</td>
<td>The United States</td>
<td>[20]</td>
</tr>
<tr>
<td>Types of crowd-funding</td>
<td>Indiegogo</td>
<td>The United States</td>
<td>[7]</td>
</tr>
<tr>
<td>Crowd-Funded Journalism</td>
<td>Spot.us</td>
<td>The United States</td>
<td>[12]</td>
</tr>
</tbody>
</table>

**POSITION 2: THE PHENOMENA OF REWARDED-BASED CROWDFUNDING IN CHINA**

As mentioned above, crowd-funding was introduced to China by Demohour four years ago. Given its nascent nature, China’s crowd-funding has not been granted legal definition and status. Thus, it’s easily associated with illegal fundraising which would lead to negative perceptions; even so, many SMEs and individual entrepreneurs express enthusiasm for the crowd-funding modes. Some entrepreneurs prefer crowd-funding as an additional funding approach, but some others consider its marketing functions more.
Soliciting Funds Is Important, But It Is Risky and Difficult via Crowd-funding Platform in China.

First, crowd-funding is regarded as an innovative financial tool in China, but it is not easy to distinguish from illegal fundraising without a legal define by far. Lots of Chinese people are suffering or suffered illegal fundraising cases, which also financing from the public like crowd-funding, involving many industries such as agriculture, real estate, technology, and equity investment, and a huge amount of money. Thus, the government has grown increasingly concerned with illegal fundraising. An institution named the Interagency Anti-Ilegal Fundraising Taskforce (IAIFT) was created in 2008, and harsh punishment came into action. To avoid being associated with illegal fundraising, most Chinese reward-based crowd-funding platforms employ strict risk control measures; furthermore, some administrators of crowd-funding platforms declare finance-disrelated operation rules to keep far away from the risk of illegal fundraising. The transformation of Demohour from a typical crowd-funding platform to a pre-sell e-commerce website may be such a case. Institutional environment has a significant effect on the development of crowd-funding in China.

Second, different with founders in US-based crowd-funding platforms such as Kickstarter or Indiegogo, who can solicit funds from foreign investors freely, Chinese crowd-founders face more difficulty in obtaining foreign investment via the Internet. At present, the RenMinBi (RMB) is the only currency and trade settlement instrument in China. All foreign capital flows in and out of China are still tightly controlled, and any incoming capital will be strict monitored. Therefore, Chinese crowd-funding platforms can not attract foreign participants easily; most projects in China can only be supported by domestic backers. It’s also the institutional environment that constrained the capacity of Chinese crowd-funding projects.

Third, compared with English-based platforms, the commonality of Chinese-based crowd-funding websites are lower. English is regarded as a world language, while Chinese is only available within Chinese-circle. As a subsequence, most participants of Chinese-based crowd-funding projects are still Chinese. From both the goals of fundraising and marketing, language is a significant limiting factor.

Founders Prefer Pre-selling Mature Products via Reward-Based Crowd-funding Projects.

Pre-selling used in Chinese crowd-funding projects is different with it in the US or Europe market. In line with [18], founders could “pre-sell” products or services to backers, who play the role of early consumers, in reward-based projects; [3] also suggested entrepreneurs inviting early consumers to “pre-order” the product to collect the initial capital for launching production. At least, the meaning of “pre-sell” is different in the context of crowd-funding with which in the traditional marketing settings. Further, in terms of traditional pre-sell, the procedure starts from production, next is sales (including pre-selling) and return of money; while the “pre-sell” in crowd-funding starts from fundraising, in other words, collecting money is the first step, and then is pilot production and normal production. Many Chinese crowd-founders utilize the traditional concept of “pre-sell” in their projects, namely, they pre-sell produced products via crowd-funding projects. However, in both Chinese-style and US-based crowd-funding projects, a common target is to obtain timely market feedback and precise consumer targeting for the “pre-sell” products [18]. Some reasons may be able to explain the special phenomena in China.

First, according to [11], China had more than 70 reward-based crowd-funding platforms at the end of 2014. Some of them do not have a clear provision for banning mature product and service, or admitting mature items directly. For example, many founders in TaoBao Crowd-funding are sellers of TaoBao stores, who can pledge the “pre-selling” product to the crowd-funding webpage, which is linked with the online store. In this case, crowd-funding project seems a warm-up of the subsequent sales for the product, regardless of the project is successful or not. Another type of platform may target to improve the website traffic by admitting “pre-sell” produced items in the early period of the website launch.

Second, from the perspective of founders, pre-sell mature items may be helpful for improving the success rate. [11] provided relevant evidence that the success rate of Chinese reward-based projects was 77.2% in 2014, which was much higher than the number of Kickstarter, about 40%. In addition, the high success rate may have positive effect on the subsequent projects pitched by the same founders. The findings of [22] examined a similar issue and indicated that completing a project could indeed lead to contributors’ larger future contributions.

Third, many founders may attempt to avoid divulging their original works in online. Plagiarism is still a serious social issue, which is unseldom in China today. If detailed descriptions of the immature but innovative items are pledged to the crowd-funding campaigns, nobody can ensure that the ideas will not be copied or plagiarized. Therefore, many founders would rather to pre-sell the mature products. It seems like a forced choice of founders due to the lack of perfect social-credit-systems and copyright-protection-systems.

Backers Confuse Group-Purchase with Reward-based Crowd-funding.

At present, crowd-funding is still a new concept for ordinary consumers, who are attracted by crowd-funding just because they can get novel products from such websites. They spend money and receive relevant products some time later, like an online group-purchase transaction. Furthermore, most Chinese reward-based crowd-funding projects have similar appearance and operational process with a famous group-purchase website, namely, JuHuaSuan (http://ju.taobao.com). Thus, it’s understandable why many backers confuse group-purchase with reward-based crowd-funding.
**DISCUSSION**

As aforementioned, the reward-based crowd-funding in China presents some different features with Kickstarter, a typical American-style crowd-funding model. The 15 largest reward-based platforms were demonstrated in Table 2, and they were employed to have a restricted view of Chinese reward-based crowd-funding.

Firstly, more crowd-funding platforms and projects are Kickstarter-liked in China. As can be seen from Table 2, more than half (8 of 15) of Chinese largest reward-based platforms are Kickstarter-liked both in the appearance and in the operational process, although some of them mix “Charity” in the categories, which is opposed by Kickstarter. In reality, except TaoBao crowd-funding, the other four of the five largest platforms are Kickstarter-liked. All of the four platforms (including, JD Crowd-funding, Zhongchou, SuNing Crowd-funding, QingJu) open to multiple categories of projects such as Technology, Design, Film & Video, Publishing, Charity, and so on; all of them attempt to provide a viable way for inventors to fund their creative items; and they also encourage backers acting as co-producers or co-inventors by contributing their thoughts and wisdom.

Secondly, some nominal crowd-funding websites are providing traditional “pre-selling” services. Five of all the 15 platforms (including, TaoBao Crowd-funding, ARTIPO, Legongxiang, Changxianzhongchou, and 5sing) are more like pre-selling websites than crowd-funding intermediaries, albeit part of projects on them are creative and Kickstarter-liked. Taobao crowd-funding is a comprehensive platform which opens to almost every item that can be funded or pre-sold via the Internet, while other four websites are vertical platforms which concentrate on limited categories of items. For example, ARTIPO focuses on funding for paintings and calligraphy, while Changxianzhongchou provides services for farmers and helps pre-selling agricultural products.

Thirdly, small innovation for crowd-funding system is revealed. Among the 15 platforms, Dreamore and Tmeng have some features of social network service (SNS). Specifically, Dreamore focuses on providing services and a virtual community for youth who have creative ideas. Launched in 2012 with a Kickstarter-style appearance, it is transforming from a PC-based platform to a concise mobile application to better satisfy young people. In addition, Dreamore will adopt a “Keep-it-All” model, which is different with most of the others who are using an “All-or-Nothing” model. Draw on the dataset from Indiegogo, [7] revealed that “Keep-it-All” projects are being less successful fundraising than “All-or-Nothing” projects. But, nobody could predict its fate in Dreamore, because China has different environments. Another innovation presented by Tmeng, which focuses on film and video project. Founders could present projects on Tmeng to solicit funds for their films and videos; meanwhile, founders could pledge projects to collect movie scripts but not to collect money.

Additionally, Musikid is another art-related platform which in the top 15 list of Chinese crowd-funding websites, it focuses on musical project and looks more like the Germany-based musical platform, Sellaband.

Hence, as an exotic IT-artifact in China, Chinese reward-based crowd-funding remains some original characteristics; meanwhile, the special cultural and institutional environments of China have impacted it and made it transformed to fit the emerging market as well. The result would be supported by the Institutional Theory, that crowd-funding need to be changed to conform to the institutional pressures and gain legitimacy in China [17].
<table>
<thead>
<tr>
<th>ID</th>
<th>Name</th>
<th>URL</th>
<th>Launch Year</th>
<th>Sponsor</th>
<th>Category</th>
<th>Trade Volume* (Unit: ¥1000)</th>
<th>Kickstarter-liked</th>
<th>Pre-sell</th>
<th>SNS</th>
<th>Others</th>
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<td>1</td>
<td>JD Crowdfunding</td>
<td><a href="http://z.jd.com/">http://z.jd.com/</a></td>
<td>2014</td>
<td>JD.com, the second-largest e-commerce company in China</td>
<td>Smart hardware, Cultural product, Household product; Charity.</td>
<td>450,100</td>
<td>✓</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>2</td>
<td>TaoBao Crowdfunding</td>
<td><a href="https://hi.taobao.com/">https://hi.taobao.com/</a></td>
<td>2013</td>
<td>TaoBao, the largest ecommerce company</td>
<td>Technology, Agriculture, Comics, Design, Charity, Film &amp; Video, Publishing, Games</td>
<td>238,670</td>
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<td></td>
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<tr>
<td>5</td>
<td>QingJu</td>
<td><a href="http://www.qingju.com/">http://www.qingju.com/</a></td>
<td>2013</td>
<td>No</td>
<td>Any creative project</td>
<td>19,310</td>
<td>✓</td>
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<td>7</td>
<td>Kaistart</td>
<td><a href="http://www.kaistart.com/">http://www.kaistart.com/</a></td>
<td>2014</td>
<td>No</td>
<td>Any creative project</td>
<td>5,020</td>
<td>✓</td>
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<td></td>
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<td>8</td>
<td>ARTIPO</td>
<td><a href="http://www.artipo.cn/">http://www.artipo.cn/</a></td>
<td>2012</td>
<td>No</td>
<td>Art</td>
<td>4,980</td>
<td>✓</td>
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<td>Website</td>
<td>Year</td>
<td>Category</td>
<td>Success</td>
<td>Amount</td>
<td>Notes</td>
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<td>12</td>
<td>Legongxiang</td>
<td><a href="http://www.lgxzc.com/">http://www.lgxzc.com/</a></td>
<td>2015</td>
<td>No</td>
<td>Food, Charity, Publishing</td>
<td>1,500</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>13</td>
<td>Changxianzhongchou</td>
<td><a href="http://www.changxianzhongchou.com/">http://www.changxianzhongchou.com/</a></td>
<td>2014</td>
<td>No</td>
<td>Agriculture</td>
<td>1,220</td>
<td>√</td>
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<tr>
<td>14</td>
<td>5sing</td>
<td><a href="http://5sing.kugou.com/zc/">http://5sing.kugou.com/zc/</a></td>
<td>2013</td>
<td>No</td>
<td>Music</td>
<td>1,030</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Tmeng③</td>
<td><a href="http://www.tmeng.cn/">http://www.tmeng.cn/</a></td>
<td>2012</td>
<td>No</td>
<td>Film &amp; Video</td>
<td>1,010</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes:
* : Data source is 01caijing.
①: Dreamore is transforming from a Kickstarter-liked platform to a mobile application, which based on its APP products. Meanwhile, it’s a SNS for youth.
②: Musikid focuses on musical project, it looks like the Germany-based musical platform Sellaband.
③: Tmeng focuses on film and video project, in which founders not only could present projects to solicit funds but also could solicit wisdom; thus, it’s a crowd-funding platform and a SNS site as well.
CONCLUSION
In summary, at present, Chinese crowd-funding has some different characteristics with its US-based or Europe-based predecessors. Some of Chinese founders regard reward-based crowd-funding as a funding approach, while others highlight its marketing functions. The result may be due to the special institutional environments of China---lack of perfect social credit systems and legal systems, which are blocks for the finance-related crowd-funding mode. Thus, the trajectory of crowd-funding in China should conform to the environments. It becomes an inevitable result that Chinese founders make heavy use of the marketing functions of crowd-funding but make light use of the funding function at the present stage.

However, innovation and entrepreneurship are becoming new engines for China's economic development. In this way, crowd-funding is one of the potential driving forces by providing an innovative funding approach for SMEs and individual entrepreneurs on that account. Selling products is only a secondary component of crowd-funding, because the substance of crowd-funding is serving for innovation and entrepreneurship. China is perfecting the institutional and legal environment. When crowd-funding obtains a legal definition and status, many SEMs and individual entrepreneurs are expected to pay more attention on the funding function than today.

REFERENCES
CLASSIFYING REAL MONEY TRADING IN VIRTUAL WORLD
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Carrie Siu Man Lui, James Cook University, Australia, Carrie.Lui@jcu.edu.au

ABSTRACT
Virtual world activities related to the buying and selling of virtual currency, virtual items, and services with real world money are referred as Real Money Trading (RMT). Although there is a great deal of evidence for the growth of RMT in virtual world, there is also evidence to suggest that many companies are struggling to become involved with RMT. A framework for classifying RMT in virtual world is essential for devising successful virtual business strategies. A key component in the process of formulating the optimal competitive strategy is to understand the unique characteristics of RMT and the implications behind those characteristics. This study aims to propose a classification of RMT based upon the characteristics of products and services, the transaction and marketplace, as well as the currency and exchange systems.

Keywords: Virtual world, virtual economy, virtual goods, virtual property, Second Life, Entropia Universe world of Warcraft.

INTRODUCTION
Real money trading (RMT) refers to the trading of virtual world currency, virtual items, and services for real money. RMT activities are not isolated from the real world: they have created a “dual economy” where users can exchange real money flow in and out the virtual world economy and real world economy. Dependent on the market configuration of RMT in each virtual world, users may earn virtual money by engaging in various activities and experiences in virtual world or purchase virtual currency with real money.

RMT has been receiving more attention in the last 10 years due to the massive increase in the money generated in such virtual economies. RMT generated over $2.1 billion in USA alone in 2011 [23]. The social virtual world Second Life (SL) with about 900,000 active users has generated more than $500 million in GDP in 2014 [31].

It is not only real world companies that are attracted to seek commercial opportunities in the RMT market in virtual world; individual entrepreneurs have also been drawn to this new market. Although there is a great deal of evidence for the growth of RMT in virtual worlds, there is also evidence to suggest that many companies - in particular early adopters of RMT - are concerned about the return on investment in RMT and have ceased their projects. While projects such as Oracle’s Darkstar [32] and Google’s Lively have been terminated [33] due to the lack of benefits to the companies, individuals such as Anshe Chung and Aimee Weber managed to generate over $1 million of wealth from RMT [23]. Social virtual world users in SL have also got to payout $60 million in real world money. Obviously, RMT involves unique characteristics that are very different from traditional business and ecommerce. Why, we can ask, would some RMT sellers or companies be able to monitories virtual products made of digital bit while some fail to do so? Understanding these characteristics and the implications behind the characteristics are essential for devising successful RMT strategies.

The objective of this paper is to create a better understanding of different forms of RMT and their potential implications for business strategies. A classification framework of RMT is proposed based upon the characteristics of products and services, the transaction and marketplace as well as the currency and exchange systems.

RMT CLASSIFICATION FRAMEWORK
In order to provide classification framework of RMT, this study references to the components in business model and map the related RMT elements in each components. A business model is widely regarded as the process used by companies for creating and commercializing value. However, business model is much more than the way the process is implemented [7], [24]. Some researchers consider the business model as the way of making different business processes fit together, and the manner by which it takes the business toward achieving its business goals [22]. In contrast, others look at the business model as the main idea of the business strategy, where this business strategy can be applied to the different business processes [26]. A summary of different business model components based on previous research are listed in

Table 1.
Gordijn et al., 2005; Hodge & Cagle, 2004; Linder & Cantrell, 2000 have classify and investigate the existing business models in their researchers, there classification finding shows that there are a lot of common factors have been found in the in the three studies. “Value proposition”, “customer relationship”, and “revenue model” are common in the three studies, while “target customers”, “distribution channel”, “partnership”, “cost structure” is common in two of the three studies. “Capability” is only found in Gordijn et al. (2005) study, “ownership model” and “interaction model” is only found in Hodge & Cagle (2004) research.
Table 1. Business Model Comparison.

<table>
<thead>
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</tr>
</thead>
<tbody>
<tr>
<td>Osterwalder et al. (2005) e-business model</td>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>x</td>
</tr>
<tr>
<td>Hodge &amp; Cagle (2004) e-business model</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

**Value Proposition**

Value proposition refers to the type of service and/or product delivered to the customer, the different categories and features of each of these services, and/or products, and the problem or service that we are trying to assist the customer with [5], [10]. Ownership and consumption mode in the virtual worlds is linked to the type of products and service provided, and it the way of consuming these products.

**Target Customer**

This section discusses the types of targeted customer for the service and/or product which is going to be offered in VWs [5], [10]. The motivation to participate in the virtual world is the main key that can be used to target the right customer.

**Distribution Channel**

The section focuses on the channels that users need to be reached, their ways and mechanisms through which we can reach them, the integration of this process with the rest of the business model, and the cost of the overall process [5], [10]. As RMT have a different kind of markets that either run under the developer management or using 3rd party platform, distribution channel will be different based on the market characteristics.

**Customer Relationships**

This refers to the type of relationship and engagement that the customer expects from the company, the integration of this kind of engagement with the rest of the business model, and the cost of this integration [5], [10]. Also the market place and the way it works will control the different ways of customer relationships that can be used.

**Capability**

The features and functionality that can be provided by the company’s products and/or services that can add value and customer satisfaction to the items provided [5], [10]. Different virtual world provides a different tools and limitation to create items, this capability of changing the virtual world content and surrounding in the process of doing business.

**Partnership**

The key partners needed to support the business, the services needed from these partners or suppliers, and the alternative partnerships or suppliers. All of these are important to the success of the business [5], [10].

**Cost Structure**

This part focuses on the cost needed to implement all the elements in the business model and to make them integrated into an efficient whole, this costing includes testing, implementing, and improving [5], [10].

**Revenue Model**

This part focuses on the value that the customers are willing to pay for the services and/or products, the way to make payments, and the effect of the new business model on the revenue generated [5], [10]. Earning virtual currency, exchange rate direction, and exchange market all is the backbone for the revenue model in any business model.

**Ownership Model**

Ownership plays an important role in the business model, as this business model can be changed based on whether the company is owned by an individual or by a cooperation. Privately owned businesses will be act differently within the business model, when compared to cooperation owned business, as each of them will have a different vision, mission, and business drivers [11].
Interaction Model
Characteristics of the business model can be changed based on the way the seller and buyers interact with the user interface of the website, virtual world, or real store. That is why interaction plays a fundamental role in the customers’ and suppliers’ experience, and in the way they are communicating and connected together [11].

This study has developing links between business model and RMT elements through investigating the RMT elements and the business models common elements as explained in table 2.

<table>
<thead>
<tr>
<th>RMT categories</th>
<th>RMT elements</th>
<th>Business model Components</th>
</tr>
</thead>
<tbody>
<tr>
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Figure 1 shows the proposed classification framework. The proposed framework will not only be of benefit to companies and individuals who want to participate in RMT, but will also be of benefit to RMT researchers to understanding the generalization of results from existing studies as well as identifying existing research gaps for future research.

PRODUCTS & SERVICES
Types of products and services delivered to the customers form the value proposition of a business model [24]. Products and services in RMT can be classified in terms of: 1) different ways for delivering the products or services for customers; 2) possibility for users to create or design virtual products and services; 3) different cost models of the products or services; 4) different utility of the virtual products or services from virtual worlds; and 5) different kind of ownership of the products created by users and who gets the ownership of these products.
Ownership of one to the mixed items.

Crafting And

Consumption
Mode

Motivation

Products & Services

Delivery

Digital delivery [22, 19, 17, 3]

Real life [12. 5]

Mixed [1, 24, 9]

Crafting & Design

User can create items [11, 5]

User can not create items [19]

Pay once & Own [28, 24, 7, 22]

Subscription / Rent [13]

Consumable [8, 35, 36]

Appearance [19]

Functionality [19]

Property [19]

Vendor / developers own users’ creation [7]

User own their creation [7]

Figure 2. RMT products & services classification

Delivery

Delivering the virtual products and services in RMT can be accomplished through a variety of means. The most common way is the digital in-world delivery, which happens when a user buys a virtual item and they get it delivered to their virtual presence without leaving the virtual world. Another way for delivering products and services in RMT is physical delivery when a user buys a real product or services with virtual currency in virtual world. There is also a mixed delivery method where users can get both the virtual item in virtual world and an equivalent of it in real life. RMT strategies need to consider the differences of these delivery modes. For instance, the real world car manufacturer Toyota realized that launching a digital version of a car with the same appearance and features of the real life model in virtual world where users can fly or teleport may not be attractive to the virtual world users [13].

Digital delivery

Exchanging virtual currency with virtual goods is the most common type of RMT. Users can purchase virtual goods - including clothes, cars, furniture, and pets - with virtual currency. These virtual goods can then be delivered digitally to the avatar representing the users in virtual world. Users can also pay for virtual services such as real estate, education, health care, and governmental services [9], [30].

This type of RMT began in game-oriented virtual worlds, where users can exchange virtual currency, weapons and armors to enhance the appearance of their avatars and their gaming experience. Virtual currency and items are obtained through looting the corpses of fallen enemies, as rewards for completing quests, by using trade skills such as blacksmithing, and by trading [19]. Similarly in social-oriented virtual world such as SL, digital delivered virtual goods; in particular virtual fashion items are the most popular type of products in SL RMT [28].

Real life

SL has been used by many well-known real world brands in the last few years for promoting and marketing their real world products. Some of the well-known companies that have joined SL for promoting, marketing, and brand awareness purposes include 1-800-Flowers.com, Adidas, Calvin Klein, Dell, IBM, Nike, Nissan, Toyota, and Mercedes-Benz [29]. Users can browse the virtual representation of the products or the product catalogue in virtual world and click to purchase a real world version of those products. These transactions can happen within the virtual world, or users can be redirected from the virtual world to the company website to finalize the purchase and payment processes. For example, 1-800-Flowers allows SL users to browse different flowers arrangements in its SL store front and click to order and send real flowers [27].

Mixed

Delivering virtual products and services can also have a mixed delivery model. Users can interact with virtual products that have identical presence in real life and purchase both the digital and real life versions [15].

American Apparel used to provide identical products in both their virtual and real stores, in which case the customer and his avatar can wear the same model and color of jeans or t-shirt. This innovative idea combines the virtual shopping experience with the real life shopping experience by purchasing the same item in both real and virtual life [12]. Similarly, Dell has setup a shop in SL offering PCs to SL users, and also allows them to order new PCs for their real life [17].

Crafting And Design

Crafting and design of virtual products and services refers to the possibility, flexibility, and limitations for users to create virtual items. Each virtual world has its own designing tools and limitations for user created virtual items. The possibility of user created virtual items enable very different type of market structure and business opportunities for RMT.

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**User can create items**
Virtual worlds - such as Entropia Universe (EU) and SL - allows users to create virtual items only using the built-in designing tools. For example, SL users can create virtual items by clicking the Build button, which brings up a menu of 3D shapes: box, cylinder, prism, spheres, torus, tube, ring, sculpted, tree, and grass. Modifying and combining these shapes in various ways can create virtual items. Different virtual worlds have different levels of flexibility for user-created virtual items. SL also provides the Linden Scripting Language allowing users with programming skills to design the interactions of virtual items. Companies and users can use these design tools and scripting language to create virtual items such as houses, clothes, electronics, and furniture, which they can then sell to other users. There are a few success stories for individuals who have been successful sell their own designs in the virtual worlds, one of the most famous individuals is Anshe Chung, who owns a virtual estate business in SL and have extended her business to include other virtual worlds [29]. Companies also leverage the creativity and capability of these design tools to collect customer feedback for real product development. For example, car makers such as General Motors and Nissan provide customizable cars in SL to gather customer feedback from the modified vehicles[13].

**Users cannot create items**
In some virtual worlds, users are not able to create virtual items and can only obtain and use the virtual items designed by the virtual world developers. Most of these virtual worlds are the game oriented virtual worlds, such as World of Warcraft (WoW) and EverQuest. For example, WoW users can use the virtual currency (gold), to bid for virtual items such as clothing gear and guardian pets in the Auction House in the virtual world, or to purchase virtual items from vendor non-player characters [19]. In this type of RMT, the virtual world developer has exclusive control of the products or services offered.

**Consumption Mode**
Virtual products and services in RMT have various cost models. Users may pay once to own virtual items, or pay weekly, monthly, or yearly to subscribe to virtual services. Users can also pay for virtual consumable. Different consumption modes may influence RMT sellers pricing strategies and users willingness to pay for virtual items and services [5].

**Pay once and own**
Very similar to real life, purchasers pay once for a virtual item and then can own/possess it. Some virtual worlds allow the transfer of ownership of the virtual item after the purchase from one user to another user. Some even allow the purchase to edit and modify, then resell the virtual item they bought, which is the case with SL virtual items. [3], [6], [8], [9].

**Subscription / rent**
Users may subscribe or rent virtual items and services in RMT. In SL, users need to subscribe (rent) the land from the virtual world developer, Linden Lab, in order to use the land for developing or building real estate or any property. Users are allowed to use the land as long as they keep paying the subscription fees [16]. The same concept applies for renting a unit or a house in SL from other users; you need to keep paying weekly or monthly in order for you to be able to stay in the property.

**Consumable**
Virtual world experience or consumables are items which users pay for once and then consume. Consumable virtual items, once used, no longer exist in the virtual world. RMT sellers can earn from providing live performances or hosting virtual art galleries. Professional singers have conducted live music concerts in SL via their avatars in virtual world and can have conversation with the listeners [34]. RMT users can also trade virtual consumables such as virtual foods. For example, in SL marketplace, users can purchase virtual food and drink such as a consumable virtual pizza with 8 slices that are shareable, where users can share it with other SL friends [35]. In EU, tools used for hunting, crafting and mining are consumables: the tools will deteriorate when used repeatedly. Each tool in EU has a decay value assigned to control how many times the tool can be used [36].

**Motivation**
Users have different motivations for buying virtual products and services, including enhancing the appearance of their avatars, the functionality and interactions in which the avatars can perform and participate, and investment in virtual property.

Appearance mainly motivates users who would like to have a unique appearance; functionality motivates mainly gaming users who want to have stronger and more powerful avatars. Some users who spend money buying property, houses, and lands may be motivated by the investment value of virtual property.

**Appearance**
Users in VWs would like to feel that their avatars are unique in a variety of different ways, starting from appearance, clothes, feature, and items owned. This leads to the trend that users would like to buy different and unique items even if they have to pay real money for it [19].

**Functionality**
Users of virtual worlds who are more game oriented are more attracted to develop their avatars functionalities. Starting from their avatars strength in different ways such as attaching techniques, defending techniques, strategy, and intelligence. For this
reason users are willing to spend hours in-game developing these functionalities, or to buy these functionalities when possible [19].

**Property**

Owning and renting properties is also interesting to a specific type of users in VWs. These users are motivated to buy their different kind of properties such as lands, units, houses, and business. Virtual worlds provide different housing options available with different sizes, features, and landscapes.

An example of property investment is Australian EU player named David Storey, who bought a virtual island in EU for PED 265,000. The property itself is a lush tropical island complete with a castle, “Storey says he considers it an investment and aims to make a profit as MindArk continues to develop the island. In June he said he had already recovered approximately USD 9,000 through taxation and property sales” [19].

**Ownership**

Ownership rights used to be one of the main issues in RMT. Ownership rights and terms of service vary significantly from one virtual world to another. Virtual item ownership is defined by the terms of services of each virtual world.

**User own their creation**

Virtual worlds such as SL have given the ownership rights to the users who create their virtual items inside the virtual world. Sellers can give specific permissions for their virtual item created by themselves when they sell it. For example, SL gives the users the ownership rights for the virtual items they create, with the possibility of transferring the ownerships to other SL users by selling the virtual item to other SL users or transferring the items as gifts to other SL users. Virtual item creators can give permission for the buyer to edit, modify, and resell when transferring the ownership of the virtual items to the buyers [8].

**Vendor/developer own users’ creation**

On the other hand, most of the MMORPGs required user to forgo any intellectual property rights to access their virtual world. For example, Mythic Entertainment and EU terms of services defined that whatever the users created in the virtual worlds will be owned by the virtual world developers [8].

**TRANSACTIONS & MARKETPLACES**

Transaction and market environment can greatly impact the nature of an economy. The characteristics of the transaction nature of the marketplace are discussed in this section.

![Figure 3. RMT transactions and market environment classification](image)

**Transaction Type**

Transactions in RMT can be divided to 5 main types, based on the characteristics of the two entities involved in the transaction. These include Developer-to-Business (D2B), Developer-to-Customer (D2C), Business-to-Business (B2B), Business-to-
Customer (B2C), or Customer-to-Customer (C2C).

**D2B**
Developer to Business RMT refers to the transactions that take place between real world businesses and virtual world developers. For example, the transaction between Linden Lab, SL developer and companies such as Dell, IBM, and Toyota for rent or buy a land in SL for hosting their virtual storefronts are considered as D2B RMT [4],[10].

**D2C**
Developer to Customer RMT refers to the transactions that take place between virtual world developers and virtual world individual users. For example, WoW users purchasing tokens from Blizzard, the developer of WoW, for exchange gold in the game and SL users purchasing land from Linden Lab are considered as D2C RMT [4],[10].

**B2B**
B2B RMT transaction can take place between companies for activities in virtual world. Companies such as The Electric Sheep Company, The New Media Consortium, and New Business Horizons Ltd. are service providers offering services to businesses and organizations that wish to create a presence within virtual world [4].

**B2C**
Many companies get attracted to the virtual worlds (VWs) especially to the social oriented virtual worlds such as SL. Companies such as IBM acquired more than 20 islands in 2007 and thousands of its employees have created avatars in SL. The CEO of IBM announced that his company have invested US$10 million to develop the 3D internet. Leading brands such as Nike, Lacoste, and Toyota uses SL to expand their brand image products awareness [10]. The main target of these companies is to sell to their either the virtual product to virtual users or attract them to buy the real products. This type of RMT transaction is considered as B2C RMT.

**C2C**
Virtual world users have earned profits by selling virtual items that they have created or services and experience they can provide. This kind of RMT transaction that takes place between to virtual world users is considered as C2C RMT [29]. EU users collecting virtual objects, and trading these to other users is an example of C2C RMT. The transaction that happens between Anshe Chung and other SL users before she professionally managed her real estate business was considered as C2C RMT. She subsequently expanded her business and officially had her VW real estate business established in SL, and turned from a small individual business to an official business with more employees working for it[29].

**Marketplaces**
There are different types of marketplaces both inside and outside virtual worlds to support and facilitate RMT [14]. These marketplaces can be classified into 3 types: 1) in-world marketplaces where the exchange of virtual items take place inside the virtual world; 2) out-world marketplaces which is developed by the virtual world developer, usually in form of a website; and 3) 3rd party marketplaces which have emerged due to the need to exchange virtual items when no marketplaces have been provided by the game developers.

**Inside virtual world**
Virtual worlds such as WoW, EU and SL have RMT transactions that take place directly inside the virtual world (in-world). WoW users and EU users can bid for virtual items in the Auction House. They can then use, share, and exchange the virtual items within a guild. In SL, users can also purchase from and sell to one another directly [14]. These in-world marketplace provides an immersive virtual world shopping experience that resembles the shopping experience in real life.

**Outside Virtual Worlds But Under Developer Control**
Virtual worlds such as SL have a website which is called Second Life Marketplace (www.marketplace.secondlife.com) where users can list virtual items that they have created for sales, and can search for virtual items available for purchase. This marketplace provides a completely open trading platform between users with the transaction take place there using L$[14].

**Outside Virtual Worlds But Not Under Developer Control**
Some virtual worlds do not have a marketplace for virtual item exchange. For example, before introducing the Station Exchange service, EverQuest did not have a dedicated marketplace. For such virtual worlds there are different kinds of marketplace that have been generated outside the virtual worlds and outside the game developer control [15,16]. Users may also make use of online marketplace for e-commerce such as eBay to post their virtual items for sale or auction. The buyer can buy or bid on the items, then pay through credit cards or via PayPal, with both the buyer and seller arranging how to deliver the virtual items in the virtual world [15,16].

**CURRENCY & EXCHANGE MARKET**
Monetary systems for RMT are different in different virtual worlds, with various types of virtual currency and currency exchange systems. For the transaction to take place in the virtual worlds there is a need for a monetary system to be used; there have been
two common Monterey systems used in the virtual world which are virtual currency (such as PED in EU or L$ in SL) and gold which is used in WoW and EverQuest.

Users have different ways to obtain virtual currency, and different virtual currencies could have an exchange rate that is determined by different mechanisms. This section is going to discuss these unique characteristics of the monetary systems used in the RMT of different types of virtual worlds.

![Currency Exchange Market Diagram](image)

**Currency Exchange Direction**

There are mainly two different types of currency exchange directions in VWs, one-way direction; where user can exchange the real money to virtual currency and cannot exchange the virtual currency back to real money (such as WoW Gold). Alternatively, in two-ways virtual currency exchange such as the exchange of real money to L$ and PED, users can exchange real money to virtual currency as well as exchanging virtual currency back to real money.

**One-way**

Virtual worlds such as WoW and EverQuest offer only one-way direction of exchanging currency through their exchange systems. User can buy gold using real money through different transaction methods such as PayPal or credit/debit cards. But if users have more gold than they need, they will only be able to exchange the gold with virtual items in the virtual worlds and they will not be able to change gold back to real money [16], [29]. The only way WoW users will be able exchange gold back to real money is to take place outside the developers control using some 3rd party websites. However, users caught performing such transactions outside WoW can have their accounts terminated or be banned [3], [6].

**Two-ways**

Both SL and EU have their own exchange rates, where SL has free market exchange rates while EU have a fixed exchange rate [16,24]. Both of EU and SL provide the two-way transactions where users can exchange U.S. dollar to PED or L$ and vice versa using they developer/vendor exchange system. Players can buy virtual currencies from game developers by using a credit card, PayPal, bank transfer or various online payment systems, and when players wish to sell their extra virtual currency back to the developer using the current exchange rate, the developer sends the money using an international bank transfer [19], [29].

**Exchange Rate**

Virtual currencies used for RMT in different virtual worlds have different currency exchange systems. The exchange rate of the virtual currency can be free market exchange rate changing (based on the demand and supply), or pre-determined fixed exchange rate (determined by the virtual world developers), and a flexible exchange rate (negotiable between users). Different exchange rates of virtual currency will have significant impacts and risks on pricing and business strategies for RMT, similar to those of international trade.

**Free market**

L$ has a free market exchange rate on the demand and supply of the currency, user can exchange L$ with real money using SL official L$ Exchange, LindeX, or other 3rd party L$ exchange services. In 2011, it is reported that the users was able to buy L$ at L$ 260 for US$1 plus the service fees, while in 2010 the exchange rate is at about L$ 269 for US$1 [16], [29]. Another example of the free currency exchange rate is the new token trading system introduced in April 2015 by Blizzard for its WoW virtual worlds. It have been reported that the initially the exchange rate for each one climbed past the 30,000 at the launch of the new
Fixed rate
On the other hand, virtual worlds such as EU have a fixed exchange rate determined by the developer at $1 for 10 PED [19].

Negotiable between users
The new token trading system introduced for WoW is only for the North America users. While transaction taking place between users from other regions than North America for gold, items, and user’s account transfer was taking place unofficially, against the WoW terms of services, in other websites. These websites are specializing in buying the gold from users who want to sell gold with low price and sell it to other user with higher prices and generating profits [19]. Users can sell gold, virtual items, and user’s accounts directly to each other, the selling and buying rate will be negotiated between the buyer and seller. The same kind of transactions between EverQuest users is found in online marketplaces such as eBay and in PlayerAuctions.com. However, EverQuest developer, Sony Online Entertainment has later banned this kind of transactions.

Earning / Getting Virtual Currency
There are different ways that users can gain virtual currency, and these ways are different from one virtual world to another. Most of the gaming virtual world users need to fight or complete missions in order to gain gold (such as WoW and EU). Other virtual users can work in the virtual worlds, working as a sales person and real estate agent is common in SL. The other easiest option is to buy exchanging real money with virtual currency based on the exchange market rate.

Buy online
SL, EU and WoW have promoted their virtual currencies to have a real value. In SL, users can buy L$ in-world paying real money using online payment methods such as credit card or PayPal. SL also has a virtual exchange office where user can buy L$ for the current market rate or request a limited buy offer with better exchange rate [25], [29]. In EU, users can purchase PED with real money and can also withdraw PED to their real world bank account through the company website. In April 2015 Blizzard, developer of WoW, allows North American WoW players to swap real cash for game gold [2].

Fight / mining
In both EU and WoW users can gain items or gold, which can then be used or be sold. In EU, after completing some fighting/quests, items will be dropped for users to collect. These collected items can then be sold to other users for earning PED. Similarly, in WoW, when users slay monsters or accomplish the quests they gain virtual items which can be sold to computer-controlled merchants for gold in the player-to-game economy [9], [25].

Work
Getting employed in the virtual worlds is another alternative way to get virtual currency. In SL, for example users can work in one of many businesses which are established there, in order to earn Linden Dollars (L$). There are different types of jobs that SL users can undertake to earn L$. These jobs include serving as a real estate agent, a salesperson, a customer services and support staff, a disc jockey or a dancer in SL [16], [29]. Avatars also can work as a freelancer where they can use their skills in producing virtual items such as pets, cars, clothes, houses, and electronics, which they can then sell to other users in return for L$.

CONCLUSIONS
Various attempts of RMT by well-known brands have not yet received the returns on investment as expected. While there are some significant transactions and new forms of RMT business emerged. What are the factors that influence the success of RMT and the characteristics of different types of RMT are essential questions to ask for formulating a viable RMT business strategy. In this study, we have outlined a classification framework for RMT based on the characteristics of products and services, the transaction and marketplace as well as the currency and exchange systems. Such a classification is necessary because the market environment and products and services offered in RMT can be very different from traditional market and e-business. How much companies can capitalize on the growth of RMT depends upon how much we understand the characteristics of this new virtual economy and marketplace.

LIMITATIONS & FUTURE STUDIES
There are several limitations in this study that can generate an opportunity for further studies. Our study is focusing on only 5 virtual worlds without collecting information from users of virtual worlds, especially in terms of their expectations, concerns, opinions and attitudes.

Future research could conduct a similar investigation but in more MMORPGS platforms based on different platform bases and economic system, which would help adding robustness to our research. Empirical examination is needed in future research to further validate the findings in this study by examining the different MMORPGS.
REFERENCES


CLOUD COMPUTING ADOPTION: A MAPPING OF SERVICE DELIVERY AND DEPLOYMENT MODELS

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ABSTRACT

The recent upward trend in adopting cloud computing by businesses worldwide reflects the captivating opportunity of cost effective computing brought by cloud computing to replace the traditional IT computing services model. However, the decision to adopt cloud computing is somewhat complex. This paper will review the literature of cloud computing service and deployment models with the aim to determine the relevant characteristics of both service delivery and deployment models. Then, the authors will develop a mapping between the two sets of characteristics of cloud computing models. The mapping will lead to the development of a decision-making framework for managing cloud-computing adoption.

Keywords: cloud service delivery models, cloud deployment models, cloud computing adoption, characteristics of cloud computing models, managing cloud computing adoption

INTRODUCTION

The National Institute of Standards and Technology (NIST) described the cloud model as consisting of five essential characteristics of cloud computing, three service delivery models, and four deployment models [14]. Essential characteristics include on-demand self-service, broad network access, resource pooling, rapid elasticity, and measured service. NIST’s three service models are Software as a Service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS). NIST’s four deployment models are private cloud, public cloud, hybrid cloud, and community cloud. The recent statistics on the cloud computing technology market are surging. A recent study by Al-Jabri [2] found that more awareness about cloud computing leads to more adoption. Cloud computing has provided an attractive alternative for many businesses in terms of cost saving in establishing and maintaining IT resources [17]. Establishing an IT function, managing software licensing and up-gradation to meet ever fast growing computing demands are complex and costly as well. However, the cloud-computing industry offers businesses a number of different adoption scenarios. Therefore, businesses face a number of decision-making issues in their endeavor to adopt cloud computing to support their business processes and operations. For example, which of the cloud delivery models from available options (SaaS, PaaS, or IaaS) is best to adopt? In addition, which deployment model amongst the common models (private, community, public, or hybrid) suits their environment and fulfills their requirements? Answering these decision questions is not simple and requires the consideration of the relevant decision factors, which in turn generates multiple decision scenarios simultaneously. A review of literature revealed a lack of research work in addressing the above two questions pertaining to managerial decision making of cloud computing adoption.

This paper aims to explore existing research on cloud computing. It is theoretical in nature, as it provides a literature review that focuses on the characteristics of cloud computing service and deployment models and then highlights their inter-relationships by developing a mapping between them. The paper begins by explaining cloud computing. It then defines cloud-computing technology and discusses benefits and risks of cloud computing adoption. Then, it will determine a set of characteristics of both service delivery and deployment models. Next, it will build a mapping between these characteristics with intent to propose a decision-making framework for managing cloud-computing adoption. This paper will provide new insights into the area of managing cloud-computing adoption. In addition, it will extend our understanding of the characteristics of cloud computing service and deployment models and the relationship between them.

BACKGROUND

Of the many definitions found in literature, one portrayed by the NIST has been acknowledged as the most comprehensive one and is widely accepted. NIST defines cloud computing as “A model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g. networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction” [8, p.11] [14]. Initially web-based and start-up companies started providing cloud services [11]. Then major players like Amazon and Google followed. Because of on-demand self-service, extensive network access, resource pooling, speedy elasticity, and measured service characteristics, cloud computing has been cited as ‘the fifth utility’ (along with water, electricity, gas, and telephone), whereby computing services are readily available on demand, like other utility services available in today’s society [3]. Despite of the benefits of cloud computing, its adoption is not without challenges. Xin-ping et al [24] highlighted challenges of adopting cloud
computing in the medical industry. Among key challenges, bandwidth, security, authentication, management, resource development, and charging methods were mentioned. Cloud computing provides on-demand services over computer networks. Cloud customers do not possess, manage or maintain the applications, platforms, data, etc. but only use them as final products by accessing services with IT support. The advantage is that it reduces costs of application-based construction and maintenance. However, the risk of data leakage becomes a major issue because application and data servers are located outside company premises, unless the company uses a private cloud. Khajeh-Hosseini et al [9] posit that adoption decisions of cloud computing is not straightforward. Cost calculations are complicated; the adoption may result in a major organizational change that will affect the way employees work, and corporate governance issues are not well understood. A more recent investigation by Phaphoom et al [16] offers an extensive review of the different barriers facing cloud-computing adoption by organizations.

**MANAGEMENT OF CLOUD COMPUTING ADOPTION**

Organizations desire to have in cloud computing some attributes that are important for adoption. They have the desire for a service that is easy to understand and use, that helps users to be more economically efficient, that is more flexible, and that aids innovation and creativity in business processes [22]. Firms will definitely wish to possess high performing, secured cloud platform, with reliable service, and an accountable provider, a highly available service (minimum cuts or disruption), and greater client control of data and applications. They also wish to have scalable cloud services [1] [10]. Attaining the benefits cloud computing is not simple and not without risk. Major risk factors include security and privacy of service and data, end user or client loss of control of service and data [7]. In general, the decision making process involved in the planning and management for adopting any new technology is complex. The reason is that a number of organizational, technical, and environmental factors can affect successful decision making for cloud computing adoption [18, 21]. As for the managerial decision for adopting cloud computing, a detailed understanding of organizational characteristics and their business requirements for IT services, the features of cloud computing capabilities, and associated risks are all essential. Sun et al [20] classified existing approaches for cloud service selection from five perspectives: decision-making techniques, data representation models, parameters and characteristics of cloud services, contexts, and purposes. Sun et al [20] summarized nine dimensions, which represent cloud characteristics (parameters or factors) considered by cloud service selection approaches. These characteristics include security, performance, accessibility, usability, scalability, resource allocation, payment, reputation, and functionality. Our study focuses on identifying the relevant characteristics for deciding on the best combination of cloud delivery service (SaaS, PaaS, or IaaS) and deployment models (public, private, hybrid, and community) that fits the organizational requirements. To reach this objective, we classified the relevant cloud characteristics into three categories: (1) services delivery characteristics, (2) deployment characteristics, and (3) service and provider selection characteristics. The following three sections describe these three categories of characteristics.

**KEY CHARACTERISTICS FOR SELECTING CLOUD SERVICE DELIVERY MODELS**

For an organization to decide what type of cloud service delivery to adopt, it needs to be aware of the relevant characteristics of service delivery models. In Table 1, we defined four key characteristics that we believe are very relevant to the selection of a delivery service model among the three alternative cloud service models.

<table>
<thead>
<tr>
<th>Service model characteristic</th>
<th>Description</th>
<th>Reference</th>
</tr>
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<tbody>
<tr>
<td>Cost of service</td>
<td>Service price and payment terms</td>
<td>[5] [6]</td>
</tr>
<tr>
<td>Service adaptability to business needs</td>
<td>The degree of flexibility the firm will have with changing the cloud service workflow to suit a firm innovated business process</td>
<td>[19]</td>
</tr>
<tr>
<td>Service complexity</td>
<td>Complexity describes the degree to which the innovation is perceived as difficult to understand and complex to use. In other words, how easy to understand, learn, and use the cloud service.</td>
<td>[18] [21]</td>
</tr>
<tr>
<td>Service setup time</td>
<td>Setup/installation time taken for the client to start using service</td>
<td>[19]</td>
</tr>
</tbody>
</table>

**KEY CHARACTERISTICS FOR SELECTING CLOUD DEPLOYMENT MODELS**

Adopting organizations of cloud computing deploy one or more of the above-mentioned three cloud service models in different ways in accordance with their needs. The most common models of cloud deployment as defined by the NIST are Private, Community, Public cloud, and Hybrid cloud [14] [23]. These deployment models represent alternative options for deploying the selected cloud service model. For an organization to decide what type of cloud deployment model to adopt, it needs to be aware of the relevant characteristics of cloud deployment models. In Table 2, we defined four key characteristics that we believe are relevant to the selection of a cloud deployment model among the four alternative cloud deployment models.
Table 2. Characteristics relevant to selecting cloud deployment models

<table>
<thead>
<tr>
<th>Deployment model characteristic</th>
<th>Description</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost of cloud deployment</td>
<td>a. Initial capital cost plus</td>
<td>[19]</td>
</tr>
<tr>
<td></td>
<td>b. Additional operating cost</td>
<td></td>
</tr>
<tr>
<td>Security of data</td>
<td>Security level of the used service and client data maintained by the cloud deployment model. This includes:</td>
<td>[5] [7] [15] [20]</td>
</tr>
<tr>
<td></td>
<td>a. Data integrity (data accuracy and recovery)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b. Level of audibility</td>
<td></td>
</tr>
<tr>
<td></td>
<td>c. Access control</td>
<td></td>
</tr>
<tr>
<td>Privacy of data</td>
<td>a. Degree of confidentiality of data maintained by the cloud deployment model</td>
<td>[7]</td>
</tr>
<tr>
<td>Control of service and/or data</td>
<td>a. Location of Client’s data storage (client’s local server or cloud server)</td>
<td>[7] [15]</td>
</tr>
<tr>
<td></td>
<td>b. Manageability</td>
<td></td>
</tr>
<tr>
<td></td>
<td>i. Ease of monitoring the service</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ii. Autonomy (degree of political control or ownership the firm will exercise on the cloud service)</td>
<td></td>
</tr>
</tbody>
</table>

**MAPPING OF THE CHARACTERISTICS OF SERVICE DELIVERY AND DEPLOYMENT MODELS**

Next, we map the service delivery characteristics with the deployment characteristics in order to reach a decision on the combination of service delivery and deployment models that match or qualify certain organizational requirements and characteristics. Assuming that an organization has already determined to switch to or adopt cloud computing, then it needs to make two more decisions. (1) What service delivery model and what deployment model to choose or adopt (for example, public SaaS, public PaaS, private SaaS, hybrid SaaS, etc.). (2) To select the right service and provider from a set of alternative services and their providers. We believe that two logical steps are involved in making such decisions. First, an organization will need to determine the delivery model and deployment model to adopt. Second, it will then need to select the best service from the alternative cloud services and providers. This study focuses on developing a framework, which assists management to make the first decision. To be able to choose the right combination of the service delivery model and the deployment model, we construct a mapping between the characteristics that are relevant to selecting a service model against the characteristics relevant to selecting the deployment model. This mapping will produce 12 cells representing 12 combinations of service delivery and deployment models. Each of these combinations will imply the conditions that fits certain types of organizational requirements for cloud computing. Thus, an organization can choose the right combination cell that best matches their requirements.

Table 3 depicts a mapping between the three service delivery models against the four standard deployment models. As mentioned above, after having decided which service delivery and deployment models to adopt, the second step of our approach is to search for alternatives of the selected service and deployment models from the available cloud providers. Then, once we have found a set of alternatives, we can apply the multi-criteria decision making approach to select the best service and service provider. The multi-criteria decision-making approach and methods handle this kind of decision problem well [19] [20]. The key factors and their sub factors that are relevant for the selection of the service and service provider depends on the service and the provider. Examples of these characteristics include cost, suitability of service to organization IS needs, agility (adaptability, compatibility, scalability, and setup time), reliability (uptime, disaster recovery, compliance, stability, and reputation), usability (setup complexity, ease of learning and use), performance (response time, user support, and network bandwidth), and accountability (provider auditability, data ownership, provider ethicality, and sustainability) [12] [13] [18]. The case of independent software vendors offering their software as a service from a Cisco private cloud infrastructure [4] illustrates the applicability of such mapping in helping managers to decide on the combination of service delivery and deployment models to adopt.

**IMPLICATIONS AND CONCLUSIONS**

This paper identifies the characteristics/factors that are useful for the evaluation and selection of the type of service delivery model and deployment model an organization will adopt. We developed a mapping between the identified characteristics of cloud computing service and deployment models. Based on the mapping, we will identify a set of conditions that qualify an organization for the adoption of the correct combination of the cloud service delivery and deployment models. The literature review undertaken in this paper is a part of a larger study, which establishes a starting point for an investigation for the validation of the proposed mapping and associated conditions as a mechanism to assist management to determine the correct service delivery model and its deployment. We believe this decision is critical for the adopting organization and should take place before selecting the desired service and service provider. Thus, the outcome of this paper provides a platform, which will lead for the development of a multi-criteria decision making method to assist in selecting the service and service provider, which will be the next phase of the study.
Table 3. A mapping between cloud computing service delivery models and deployment models

<table>
<thead>
<tr>
<th>Service Model</th>
<th>Deployment</th>
<th>SAAS</th>
<th>PAAS</th>
<th>IAAS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>PRIVATE CLOUD</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Service is ready made software</td>
<td>1. Service is platform for developing, hosting, and running applications by the client</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Cost is medium as private cloud costs more than public</td>
<td>2. Cost is high as private cloud costs more than public and PaaS costs more than SaaS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Adaptability is limited since flexibility with changes of IS needs is limited (application belongs to provider and under his control)</td>
<td>3. Adaptability is high since flexibility with changes of IS needs is not limited as the application is under control of client</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Complexity is low as the SaaS service is easy to install and use</td>
<td>4. Complexity is high as the PaaS service requires IT technical, functional, and development skills to use</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Setup time is moderate</td>
<td>5. Setup time is high</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Service is under the control of the provider as it is managed by the cloud provider</td>
<td>6. Service is under the control of the provider, as the provider owns it, but the developed applications are under the control of the client</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Data security is high since client data is stored on a private cloud</td>
<td>7. Data security is high since client data is stored on a private cloud</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Data privacy is high since client data is stored on a private cloud</td>
<td>8. Data privacy is high since client data is stored on a private cloud</td>
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<td></td>
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<tr>
<td><strong>PUBLIC CLOUD</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Service is ready made software</td>
<td>1. Service is platform for developing, hosting, and running applications by the client</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Cost is low as public cloud is shared by multiple clients</td>
<td>2. Cost is medium as PaaS costs more than SaaS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Adaptability is limited since flexibility with changes of IS needs is limited (application belongs to provider and under his control)</td>
<td>3. Adaptability is high since flexibility with changes of IS needs is not limited as the application is under control of client</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Complexity is low as the SaaS service is easy to install and use</td>
<td>4. Complexity is high as the PaaS service requires IT technical, functional, and development skills to use</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Setup time is minimal</td>
<td>5. Setup time is moderate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Service is under the control of the provider as it is managed by the cloud provider</td>
<td>6. Service is under the control of the provider, as the provider owns it</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Data security is low since client data is stored on a public cloud</td>
<td>7. Data security is low since client data is stored on a public cloud</td>
<td></td>
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<tr>
<td>8. Data privacy is low since client data is stored</td>
<td>8. Data privacy is low since client data is stored</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HYBRID CLOUD</td>
<td>COMMUNITY CLOUD</td>
<td>IaaS</td>
<td>PaaS</td>
<td>SaaS</td>
</tr>
<tr>
<td>--------------</td>
<td>----------------</td>
<td>------</td>
<td>------</td>
<td>------</td>
</tr>
<tr>
<td>1. Service is ready made software</td>
<td>1. Service is platform for developing, hosting, and running applications by the client</td>
<td>1. Service is infrastructure for developing, hosting, and running applications by the client</td>
<td>1. Service is platform for developing, hosting, and running applications by the client</td>
<td>1. Service is infrastructure for developing, hosting, and running applications by the client</td>
</tr>
<tr>
<td>2. Cost is low to medium as cost will include hiring private cloud</td>
<td>2. Cost is medium to high as private cloud will be used in addition to the public cloud plus PaaS costs more than SaaS</td>
<td>2. Cost is medium as community cloud will be shared by multiple clients</td>
<td>2. Cost is medium as PaaS costs more than SaaS</td>
<td>2. Cost is medium as community cloud will be shared by multiple clients</td>
</tr>
<tr>
<td>3. Adaptability is limited since flexibility with changes of IS needs is limited (application belongs to provider and under his control)</td>
<td>3. Adaptability is high since flexibility with changes of IS needs is not limited as the application is under control of client</td>
<td>3. Adaptability is high since flexibility with changes of IS needs is not limited as needed resources are easy to scale up or down by the provider to fulfill client needs</td>
<td>3. Adaptability is high since flexibility with changes of IS needs is not limited as needed resources are easy to scale up or down by the provider to fulfill client needs</td>
<td>3. Adaptability is high since flexibility with changes of IS needs is not limited as needed resources are easy to scale up or down by the provider to fulfill client needs</td>
</tr>
<tr>
<td>4. Complexity is low as the SaaS service is easy to install and use</td>
<td>4. Complexity is high as the PaaS service requires IT technical, functional, and development skills to use</td>
<td>4. Complexity is medium as the IaaS does not require much IT skills to use</td>
<td>4. Complexity is high as the PaaS service requires IT technical, functional, and development skills to use</td>
<td>4. Complexity is medium as the IaaS does not require much IT skills to use</td>
</tr>
<tr>
<td>5. Setup time is moderate</td>
<td>5. Setup time is high</td>
<td>5. Setup time is moderate</td>
<td>5. Setup time is high</td>
<td>5. Setup time is moderate</td>
</tr>
<tr>
<td>6. Service is under the control of the provider as it is managed by the cloud provider</td>
<td>6. Service is under the control of the provider, as the provider owns it, but the developed applications are under the control of the client</td>
<td>6. Service is under the control of the provider, as the provider owns it</td>
<td>6. Service is under the control of the provider, as the provider owns it</td>
<td>6. Service is under the control of the provider, as the provider owns it</td>
</tr>
<tr>
<td>7. Data security is moderate since client sensitive data will be stored on a private cloud</td>
<td>7. Data security is moderate since client sensitive data will be stored on a private cloud</td>
<td>7. Data security is moderate since client sensitive data will be stored on a private cloud</td>
<td>7. Data security is moderate since client sensitive data will be stored on a private cloud</td>
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<td>8. Data privacy is moderate since client sensitive data will be stored on a private cloud</td>
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<td>8. Data privacy is moderate since client sensitive data will be stored on a private cloud</td>
<td>8. Data privacy is moderate since client sensitive data will be stored on a private cloud</td>
</tr>
<tr>
<td>10. Service is under the control of the provider, as the provider owns it</td>
<td>10. Setup time is high</td>
<td>10. Setup time is moderate</td>
<td>10. Setup time is high</td>
<td>10. Setup time is moderate</td>
</tr>
<tr>
<td>11. Data security is moderate since client sensitive data will be stored on a private cloud</td>
<td>11. Data security is moderate since client sensitive data will be stored on a private cloud</td>
<td>11. Data security is moderate since client sensitive data will be stored on a private cloud</td>
<td>11. Data security is moderate since client sensitive data will be stored on a private cloud</td>
<td>11. Data security is moderate since client sensitive data will be stored on a private cloud</td>
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<tr>
<td>12. Data privacy is moderate since client sensitive data will be stored on a private cloud</td>
<td>12. Data privacy is moderate since client sensitive data will be stored on a private cloud</td>
<td>12. Data privacy is moderate since client sensitive data will be stored on a private cloud</td>
<td>12. Data privacy is moderate since client sensitive data will be stored on a private cloud</td>
<td>12. Data privacy is moderate since client sensitive data will be stored on a private cloud</td>
</tr>
<tr>
<td>13. Setup time is moderate</td>
<td>13. Setup time is high</td>
<td>13. Setup time is moderate</td>
<td>13. Setup time is high</td>
<td>13. Setup time is moderate</td>
</tr>
<tr>
<td>14. Data security is moderate since client sensitive data will be stored on a private cloud</td>
<td>14. Data security is moderate since client sensitive data will be stored on a private cloud</td>
<td>14. Data security is moderate since client sensitive data will be stored on a private cloud</td>
<td>14. Data security is moderate since client sensitive data will be stored on a private cloud</td>
<td>14. Data security is moderate since client sensitive data will be stored on a private cloud</td>
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<tr>
<td>15. Data privacy is moderate since client sensitive data will be stored on a private cloud</td>
<td>15. Data privacy is moderate since client sensitive data will be stored on a private cloud</td>
<td>15. Data privacy is moderate since client sensitive data will be stored on a private cloud</td>
<td>15. Data privacy is moderate since client sensitive data will be stored on a private cloud</td>
<td>15. Data privacy is moderate since client sensitive data will be stored on a private cloud</td>
</tr>
</tbody>
</table>
ACKNOWLEDGEMENT

This project was funded by the National Plan for Science, Technology, and Innovation (MAARIFA) – King Abdulaziz City for Science & Technology – through the Science & Technology Unit at King Fahd University of Petroleum & Minerals – Kingdom of Saudi Arabia, award number (14-INF83-04)

REFERENCES

COGNITIVE TRUST, EMOTIONAL TRUST AND THE VALUE-BASED ACCEPTANCE MODEL IN MOBILE PAYMENT ADOPTION

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ABSTRACT

Mobile commerce has grown rapidly worldwide and become globally competitive in the last decade. Despite the fact that mobile payment is a key enabling part of mobile commerce, consumers’ adoption has been lacking behind the adoption of many other mobile commerce activities. How to facilitate consumers’ adoption of mobile payment remains an important open question. Drawing on the attribution theory and value-based acceptance model, this study investigates the role of consumers’ trust on mobile payment adoption. In contrast to prior research, we develop a research model to examine the influence of both cognitive and emotional trust on consumers’ perceived value and the subsequent usage intention. We examine four dimensions of perceived value, namely functional, emotional, price and social value in the mobile payment context. The model is empirically tested with an online survey (n=273). Our results indicate that emotional trust has a much stronger effect than cognitive trust on consumers’ value perceptions. Further, functional, emotional and price value gain prominence in predicting adoption intention, while the effect of social value is insignificant. Discussions on limitations, theoretical and practical implications are provided.

Keywords: Mobile payment services, cognitive trust, emotional trust, perceived value, information technology adoption.

INTRODUCTION

The proliferation of mobile devices and the advancement in wireless network have greatly facilitated the development of mobile commerce [16]. As an extension of electronic commerce (e-commerce), mobile commerce is becoming an insepable part of today’s business arena due to its capability of offering greater flexibility and mobility to online transactions [25]. A recent industrial report shows that the global mobile commerce is worth US$230 billion, with nearly half of the market coming from Asia, and has been forecasted to hit US$700 billion revenue by 2017 [22]. In this circumstance, mobile payment (MP), as a critical service supporting mobile business, has received great attention from enterprises. For example, Google has released its MP product: Google wallet. E-commerce companies like eBay and Alibaba have also released MP services, which allow users to conduct payments conveniently by tapping their mobile phones when checking out.

Given the significance of MP services, a large number of studies have been conducted to understand MP users’ behavior and identify factors affecting their adoption of MP. Among the many factors, trust has been found to be a key predictor for consumers’ usage intentions [2, 4, 5]. Most of these studies adopt a universalist approach to assume that trust is a set of cognitive beliefs regarding the positive characteristics of the trustee, and propose MP adoption as a trustor’s purely cognitive decision. For example, Shin [1] contended that consumers’ initial trusting beliefs is positively associated with intention to use a mobile wallet. Lu et al. [4] found that consumers’ cognitive trust play a vital role in promoting their personal intention to use MP. In a similar vein, cognitive trust in MP has been found to affect behavioral intention by increasing satisfaction [42], attitude [24], perceived usefulness [3], perceived ease of use [31], performance expectancy and reducing perceived risk [25].

On the other hand, recent information systems (IS) scholars begin to question whether it is sufficient to only examine cognitive trust in online environments. For instance, Komiak and Benbasat [10], [11] argued that individuals’ experience contains both cognitive and emotional aspects. It implies that consumers’ emotional reactions (e.g. feeling secure or not) should not be ignored. In the context of this study, MP is a highly personalized information technology (IT) that allows users to adopt personal mobile terminals like mobile phones to conduct payment for bills, goods and services [42]. Such a unique and personalized IT further requires consumers’ to make trust decisions not only based on the rational appraisal of the trustee’s reliability and competence, but also based on the feelings of comfort and security [21]. In fact, some IS researchers have suggested that trust involves two dimensions: cognitive trust and emotional trust [15, 33; 41]. Merely considering cognitive trust is not adequate to account for individuals’ trust decisions. Based on these concerns, this study addresses the research gap regarding the lack of MP research on the influence of emotional trust. We attempt to highlight the consequence of both cognitive and emotional trust and examining their differences in MP adoption.

We pursue our research objective by developing a trust-based research model of MP adoption. Drawing upon the attribution theory and value-based acceptance model, we argue that cognitive and emotional trust can affect consumers’ perceived value, which further influences their MP adoption behavior. The attribution theory posits that a trustee’s social perceptions may result from his/her attribution process [21; 28]. For instance, the trustee may positively interpret the trustee’s characteristics or actions by attributing causes to the trustee’s internal characteristics [10]. In the case of MP adoption, we therefore examine whether a consumer will perceive high value of a MP service after recognizing its trustworthiness. According to the value-based acceptance model developed by Turel et al. [14], we refer to perceived value as consumers perceptions regarding the benefits
from using an information technology [18]. We further delineate four dimensions of perceived value [5; 35; 37], namely functional, emotional, price and social in the MP adoption context. We expect that the four dimensions are key determinants of consumers’ usage intention of MP.

The rest of the article is organized as follows. In the next section, we review the previous literature on the attribution theory and value-based acceptance model. Then, we develop our research model and the hypotheses. Next, we report the survey procedure and the results of the data analysis. Finally, we conclude this research with discussions on both research and practice implications.

**THEORETICAL BACKGROUND**

**Attribution Theory**

Among the possible theoretical perspectives, the attribution theory [14] has been widely used by IS researchers to explain trust-related problems, such as initial trust building in online marketplace [8; 23; 32] and the role of trust in virtual teams [10]. Attribution is the process by which individuals try to explain the causes of behaviors and actions. According to the theory, when a behavior is consistent with people’s prior expectations, they tend to attribute the causes of the action to one’s internal characteristics; in contrast, when the behavior is inconsistent with people’s prior expectations, they are likely to attribute the causes to external situational characteristics [14]. In Teo et al.’s [26] study, they applied this theory to examine the relationship between trust and quality perceptions of e-government website services. They argued that citizens with high trusting beliefs tend to attribute positive website experience to internal characteristics like high website quality. Similarly, citizens with low trusting beliefs attribute negative website experience to internal characteristics like low website quality. Hence, citizen trusting beliefs are likely to affect their quality perceptions of e-government website services. Following this perspective, this study uses the attribution theory to understand the effects of cognitive and emotional trust on perceived value of MP services.

**Cognitive Trust and Emotional Trust**

Prior research refers to trust as a consumer’s perception that a trustee “can be relied upon to engage in generally acceptable business practices and will deliver the promised products or services, despite the possibility of exposure to loss during a transaction process” [2 pp.493]. Komiak and Bensasat [8] identified two different types of trust: cognitive trust and emotional trust. Cognitive trust is based on the trustee’s rational perceptions that the trustee has necessary attributes to be relied upon [33]. The concept of cognitive trust is derived from the definition of trusting beliefs, which conceptualize a consumer’s trust from a cognitive orientation. In contrast, emotional trust is defined as the trustee’s emotional feelings about the comfort and security of relying on the trustee [20]. Emotional trust offers a new and important angle to explain the influence of consumer’s emotions, such as his/her gut feeling and affections, on trust decisions [33]. While cognitive trust enables an individual to rationally trust a trustee, emotional trust helps him/her to feel secure and comfortable about relying on the trustee beyond available evidence. Thus, we expect that it will be beneficial to consider the effect of emotional trust besides cognitive trust in understanding consumers’ MP adoption.

**Value-based Acceptance Model**

Turel et al.’s [14] value-based acceptance model is built upon the consumption value theory [13]. The theory assumes that people’s usage choice is influenced by their value perceptions. Functional, emotional, epistemic, conditional and social value are identified as the five components of perceived value in general [12]. The consumption value theory has been applied to various situations, and the effectiveness of different dimensions is often dependent on different contexts [5]. For example, Jia et al. [2] summarized four types of values which consumers can gain from self-service technologies: functional, instrumental, emotional and social value. Brown and Venkatesh[28] considered utilitarian, hedonic and social value to predict individuals’ technology adoption of households.

Given the important role of perceived value, Turel et al. [14] proposed the value-based acceptance model to understand the adoption of mobile value-add services. The model identified four dimensions of perceived value: (1) functional value, which is derived from consumers’ utilitarian motivations, is defined as the degree to which using a technology will help consumers to perform certain activities conveniently and efficiently; (2) emotional value, also viewed as hedonic value, refers to consumers’ subjective feelings developed from using of the technology; (3) price value, also known as monetary value, captures consumers’ cognitive tradeoff between the perceived monetary benefits and costs of using the technology; and (4) social value is derive from the enhancement of social gains from using the technology. The value-based acceptance model highlights that a consumer’s behavioral intention to use a technology will be influenced by his/her perceptions of functional, emotional, price and social value. Research has shown that the value-based acceptance model is an effective tool for interpreting individuals’ value perceptions and plays an important role in predicting adoption behavior of multiple IT applications [2; 38], including mobile services [1; 5; 17; 19; 39].

Although technology adoption models such as the unified theory of acceptance and use of technology (UTAUT),technology acceptance model (TAM) and theory of planned behavior (TPB) are often applied to analyze the behavior of IT users, these models are originally developed to explain individuals’ adoption behavior in organizational settings [18; 21; 36]. An important difference between the consumer setting and organizational setting is that consumers usually bear monetary costs or benefits, whereas employees do not [38]. Therefore, factors related to usage fee or price may be considered in the consumer setting. Because the present study focuses on the adoption of ubiquitous MP services, which involve additional expenses (e.g. data
flow), as well as possibly getting some rewards or discounts for the usage [26], this research adopts the value-based acceptance model to examine consumers’ initial adoption of MP. This is consistent with the assumption of UTAUT2 which is developed in the consumer usage setting [38].

**RESEARCH MODEL AND HYPOTHESES**

Our conceptual model is depicted in Figure 1. Drawing upon the attribution theory and value-based acceptance model in the context of MP adoption, we propose that consumers’ intention to use MP will be predicted by perceived functional, emotional, price and social value. More importantly, cognitive and emotional trust will place important impacts on such perceived value.

![Research Model](image)

**Antecedents of Intention to Use**

Based on Turel et al.’s [14] value-based acceptance model, we explore the influence of four aspects of perceived value on intention to use MP services. Functional value is defined here as the degree to which using MP will provide benefits to consumers in conducting payment efficiently [38]. MP services satisfy consumers’ needs of prompt transactions [40], reducing waiting time and increasing efficiency [26], which will provide utilitarian benefits to consumers. Emotional value refers to the fun or pleasure derived from using mobile payment [29]. Prior research posits that MP services increase consumers’ involvement and sense of freedom, which will provide consumers with emotional rewards and hedonic experiences [12]. Price value captures consumers’ cognitive tradeoff between the monetary benefits and costs of MP for using it [38]. Using ubiquitous MP services involves additional expenses, such as mobile equipment costs, access costs, and transaction fees [26]. In China, in order to enlarge market share, MP service providers employ competitive pricing strategies. For example, Alibaba provides lower fees when consumers use mobile Alipay to conduct payment rather than desktop Alipay. It implies that if perceived price value is positive, consumers are likely to get monetary benefits from using MP services. Social value means that consumers will receive social gains, such as the enhancement of social self-concept, in using MP services [36]. Previous research shows that individuals’ perception of performance improvement, subjective affective state, monetary benefits and social self-concept enhancement in using mobile services will significantly influence their usage intentions [5; 39; 43]. Thus, the following hypotheses are provided:

**H1a-d:** Functional, emotional, price and social dimension of perceived value are positively associated with intention to use MP.

**Cognitive Trust and Emotional Trust**

In this study, cognitive trust is defined as consumer’s rational expectations that MP services have necessary attributes to be relied upon [27; 41]. It involves the beliefs that MP services will take the responsibility to ensure reliable, safe and accurate financial services [42]. We expect that cognitive trust in MP may have a positive impact on perceived value. The attribution theory provides the conceptual foundation for this relationship [14]. According to the theory, trust may affect a trustor’s social perceptions by attributing the causes of the trustee’s actions to either the trustee or external situational factors [10]. This means that consumers with high trust is likely to attribute flaws and errors of a MP service to external causes, whereas s/he tends to attribute its advantages to internal characteristics [34]. For example, the responsive time of the MP service is an important factor during the transaction process. Consumers tend to seek explanations for the long awaiting time when using the MP service. A high level of cognitive trust indicates that consumers believe that the MP service has the capability to provide accurate and timely services. Consumers holding such beliefs are more likely to attribute the delay to situational factors (e.g. operational failure). In this situation, the value perceptions of MP tend to change little. On the contrary, if consumers do not trust the MP service to having the capability of providing accurate and timely services, then they tend to interpret the awaiting time as internal attributes (i.e. inconvenience), which further result in low value perceptions of MP. In short, cognitive trust is likely to be positively related to consumers’ perceived value of MP. Trust acts as a type of subjective guarantee which ensures consumers to receive expected benefits from an exchange relationship [25]. Given that perceived value includes functional, emotional, price and social dimensions, the following hypotheses are provided:

**H2a-d:** Cognitive trust is positively associated with functional, emotional, price and social dimensions of perceived value.
Besides the role of cognitive trust, we further propose that emotional trust can place a positive impact on perceived value of MP. Based on prior research, emotional trust refers to a consumer’s emotional feelings about the comfort and security of relying on mobile terminals to conduct their payment [33]. It captures consumers’ evaluation of affective reactions and feelings toward MP services [20; 21]. Affect generalization is a common phenomenon where affect toward a component of an object can spread to the whole object and form subsequent judgments of the object [30]. This affect generalization is an important source of information processing bias in individuals’ attribution process. That is, individuals are more likely to pay attention to the affect-consistent information [33]. Following this perspective, we expect that a similar process is likely to occur in the MP context. When a consumer feels secure and comfort about relying on a MP service, these positive affective feelings will direct him/her to positive information about the value of using it. Conversely, if s/he holds affective feelings of discomfort and insecurity about using the service, then s/he tends to have serious concerns about using it. Thus, it becomes difficult to perceive benefits and value of using the MP service. Therefore, we propose the following hypotheses:

H3a-d: Emotional trust is positively associated with functional, emotional, price and social dimensions of perceived value.

**METHODOLOGY**

**Data Collection**

To collect data, we used an online survey method. We targeted a convenient sample of a Chinese university students and faculties who had knowledge about MP services. To ensure this, a screening question “do you know about MP services” was asked before the questionnaire. Incentives like local supermarket coupons and prepaid calling cards were provided as lucky draw prizes to increase response rate. Given that the survey was conducted in China, we translated the original English questionnaire into Chinese and then back-translated it into English. The two versions were compared to ensure the translation quality. In total, 273 usable responses were gathered for this study. Table 1 lists the sample’s demographic characteristics.

<table>
<thead>
<tr>
<th>Measure</th>
<th>Item</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>Male</td>
<td>162(59.3%)</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>111(40.7%)</td>
</tr>
<tr>
<td>Age</td>
<td>Below 20</td>
<td>16(5.9%)</td>
</tr>
<tr>
<td></td>
<td>21-30</td>
<td>225(82.4%)</td>
</tr>
<tr>
<td></td>
<td>31-40</td>
<td>22(8.1%)</td>
</tr>
<tr>
<td></td>
<td>41 or above</td>
<td>10(3.7%)</td>
</tr>
<tr>
<td>Education</td>
<td>Below college</td>
<td>29(10.6%)</td>
</tr>
<tr>
<td></td>
<td>Junior college</td>
<td>49(17.9%)</td>
</tr>
<tr>
<td></td>
<td>Bachelor or above</td>
<td>195(71.5%)</td>
</tr>
<tr>
<td>Monthly Income</td>
<td>Under RMB1000</td>
<td>83(30.4%)</td>
</tr>
<tr>
<td>(US$1=RMB6.83)</td>
<td>RMB1001-3000</td>
<td>69(18.4%)</td>
</tr>
<tr>
<td></td>
<td>RMB3001-5000</td>
<td>82(30.1%)</td>
</tr>
<tr>
<td></td>
<td>RMB5001 or above</td>
<td>39(14.3%)</td>
</tr>
</tbody>
</table>

**Data Measures**

We adapted well-validated items of constructs from prior studies [21; 26; 36; 38]. Slight wording modifications were applied to fit the MP context. A seven-point Likert scale was used for all items, from “1=strongly disagree” to “7=strongly agree”. The measurement items and their sources are provided in Appendix.

<table>
<thead>
<tr>
<th>Construct</th>
<th>Item Wording</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cognitive Trust (CT)</td>
<td>CT1: MP always provides accurate financial services.</td>
<td>[26]</td>
</tr>
<tr>
<td></td>
<td>CT2: MP always provides reliable financial services.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CT3: MP always provides safe financial services.</td>
<td></td>
</tr>
<tr>
<td>Emotional Trust (ET)</td>
<td>ET1: I feel secure about using MP for my payment.</td>
<td>[21]</td>
</tr>
<tr>
<td></td>
<td>ET2: I feel comfortable about using MP for my payment.</td>
<td></td>
</tr>
</tbody>
</table>
ET3: I feel content about using MP for my payment.

Functional Value (FV)

FV1: I find MP useful in my daily life.
FV2: Using MP helps me accomplish payment more quickly.
FV3: Using MP increases my payment productivity.

Emotional Value (EV)

EV1: Using MP is fun.
EV2: Using MP is enjoyable.
EV3: Using MP is very entertaining.

Price Value (PV)

PV1: Using MP is reasonably priced.
PV2: Using MP is good value for money.

Social Value (SV)

SV1: The use of MP helps me feel acceptable.
SV2: The use of MP makes a good impression on other people.
SV3: The use of MP gives me social approval.

Intension to Use (ITU)

ITU1: Assuming I have access to the MP, I intend to use it.
ITU2: Given that I have access to the MP, I predict that I would use it.

Data Analysis and Result

We used Partial Least Squares (PLS) to analyze the research model. PLS is a component-based structural equation modeling approach that requires a relatively small sample size with no restriction on normal distribution, and is appropriate for exploratory analysis [4]. Thus, it is suitable to use PLS for the data analysis of the current study. Following the two-step analytical procedures [9], we examine the measurement model and structural model respectively.

Testing the Measurement Model

We assessed the measurement model by examining the convergent validity and discriminant validity of the constructs. For convergent validity, the composite reliability (CR) of constructs should exceed 0.7, and the average variance extracted (AVE) should be 0.5 or above [7]. As shown in Table 3, CR values ranged from 0.93 to 0.98, and AVE values were greater than 0.83, suggesting good convergent validity of this study.

Table3.Convergent Validity of the Measures

<table>
<thead>
<tr>
<th>Construct</th>
<th>Item</th>
<th>Loading</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cognitive Trust (CT)</td>
<td>CT1</td>
<td>0.93</td>
</tr>
<tr>
<td>CR=0.95; AVE=0.86</td>
<td>CT2</td>
<td>0.95</td>
</tr>
<tr>
<td></td>
<td>CT3</td>
<td>0.89</td>
</tr>
<tr>
<td>Emotional Trust (ET)</td>
<td>ET1</td>
<td>0.91</td>
</tr>
<tr>
<td>CR=0.94; AVE=0.83</td>
<td>ET2</td>
<td>0.89</td>
</tr>
<tr>
<td></td>
<td>ET3</td>
<td>0.93</td>
</tr>
<tr>
<td>Functional Value (UV)</td>
<td>FV1</td>
<td>0.96</td>
</tr>
<tr>
<td>CR=0.98; AVE=0.93</td>
<td>FV2</td>
<td>0.97</td>
</tr>
<tr>
<td></td>
<td>FV3</td>
<td>0.96</td>
</tr>
<tr>
<td>Emotional Value (EV)</td>
<td>EV1</td>
<td>0.94</td>
</tr>
<tr>
<td>CR=0.94; AVE=0.92</td>
<td>EV2</td>
<td>0.97</td>
</tr>
<tr>
<td></td>
<td>EV3</td>
<td>0.97</td>
</tr>
<tr>
<td>Price Value (PV)</td>
<td>PV1</td>
<td>0.95</td>
</tr>
<tr>
<td>CR=0.95; AVE=0.90</td>
<td>PV2</td>
<td>0.95</td>
</tr>
</tbody>
</table>
Discriminant validity was assessed by (1) item loadings on their constructs at 0.7 or above, and (2) the square root of AVE for each construct exceeding its correlations with other constructs [7]. Table 3 shows that all items had high loadings on their corresponding constructs. Table 4 confirms that the correlations between constructs were lower than corresponding square roots of AVEs. Thus, the measures also had satisfactory discriminant validity.

### Table 4. Correlation between Constructs

<table>
<thead>
<tr>
<th></th>
<th>CT</th>
<th>ET</th>
<th>FV</th>
<th>EV</th>
<th>PV</th>
<th>SV</th>
<th>ITU</th>
</tr>
</thead>
<tbody>
<tr>
<td>CT</td>
<td>0.93</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ET</td>
<td>0.75</td>
<td>0.91</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FV</td>
<td>0.57</td>
<td>0.58</td>
<td>0.96</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HV</td>
<td>0.61</td>
<td>0.72</td>
<td>0.69</td>
<td>0.96</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EV</td>
<td>0.47</td>
<td>0.51</td>
<td>0.47</td>
<td>0.53</td>
<td>0.95</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SV</td>
<td>0.44</td>
<td>0.46</td>
<td>0.20</td>
<td>0.50</td>
<td>0.56</td>
<td>0.93</td>
<td></td>
</tr>
<tr>
<td>ITU</td>
<td>0.61</td>
<td>0.68</td>
<td>0.70</td>
<td>0.63</td>
<td>0.49</td>
<td>0.26</td>
<td>0.97</td>
</tr>
</tbody>
</table>

### Testing the Structural Model

We tested the structural model by examining the $R^2$ of endogenous variables and the significance of path coefficients in the model [4]. The results of the structural model were reported in Fig. 2. We found that functional ($\beta=0.55$, $t=10.28$), emotional ($\beta=0.25$, $t=4.42$) and price value ($\beta=0.13$, $t=2.72$) had significant effects on intention to use, providing support to H1a-c. In contrary, social value ($\beta=-0.04$, $t=0.82$) was found to have no significant effect. Thus, H1d was not supported. Our results also indicated that cognitive trust was positively associated with functional ($\beta=0.31$, $t=3.67$), emotional ($\beta=0.17$, $t=2.32$), price ($\beta=0.20$, $t=2.16$) and social value ($\beta=0.22$, $t=2.55$). H2a-d were thus supported. Meanwhile, we found that emotional trust had significant and repeatedly stronger effects on functional ($\beta=0.35$, $t=4.05$), emotional ($\beta=0.60$, $t=9.17$), price ($\beta=0.36$, $t=3.98$) and social value ($\beta=0.30$, $t=3.58$). Hence, H3a-d were also supported. Overall, the variances explained in functional, emotional, price, social value and intention to use were 39%, 53%, 28%, 24%, and 62% respectively.

![Figure 2. Structural Model (*)=p<0.05, **= p<0.01, ***= p<0.001)](image_url)

### CONCLUSION AND DISCUSSION

Drawing on the attribution theory and value-based acceptance model, this study theoretically articulates and empirically tests a research model to explicate that cognitive and emotional trust can enhance consumers’ intention to use MP by increasing value perceptions. Our results demonstrate that functional, emotional and price dimension of perceived value are important in
affecting consumers’ intention to use MP. The effect of social value is insignificance. This implies that consumers may prefer not to take MP usage as an important issue for improving their social images. More importantly, our findings demonstrate that, besides cognitive trust, emotional trust increases the perceptions of functional, emotional, price and social value. The effects of emotional trust are further shown to be stronger than those of cognitive trust, highlighting its critical role in the model.

Theoretical Implications
We expect that this study can enrich our theoretical understandings in two major aspects. First, this research extends the MP literature by applying Turel et al.’s [14] value-based acceptance model to investigate the adoption of MP. Prior studies have examined different technology adoption models in the context of MP adoption. For instance, some research relies on TAM to argue that perceived usefulness and perceived ease of use are important predictors of intention to use MP [3; 16]. The UTAUT is also applied to propose that performance expectancy, effort expectancy, social influence and facilitating conditions determine MP adoption [31; 43]. IS success model, the diffusion of innovation theory and TPB have also been used to explain MP usage behavior [26; 40; 42]. These studies are usually lack of considering the role of monetary factors in predicting consumers’ MP adoption behavior. In fact, monetary costs/benefits are important to determine the adoption of a technology in the consumer setting [38]. Overall, our results confirm the key roles of functional, hedonic and price value in affecting consumers’ adoption decision-making process.

Second, and more importantly, this study extends the trust literature by investigating the impact of both cognitive and emotional trust in the context of MP adoption. Previous IS literature mainly conceptualizes consumer’s trust as cognitive trusting beliefs (for a review, see [20]). In consistent, many researchers focus on examining the role of cognitive trust on consumers’ behavioral intention, with a lack of research emphasis on the effect of emotional trust. In view of this, the present study is among the first to address the effect of emotional trust on consumers’ value perceptions, which further lead to intention to use MP. We explain the underlying rationale by introducing the attribution theory [34]. Our empirical findings demonstrate that (1) emotional trust in MP posits a significant effect on perceived value; and (2) its effect is much stronger than that of cognitive trust in MP. We hope that these new findings can make useful contributions to the extant MP adoption and trust literature.

Practical Implications
Apart from the theoretical implications, this study also provides insightful implications for practitioners. First, the findings associated with the value-based acceptance model shed some light on how to design and promote MP services effectively. For example, service providers should provide efficient and user-friendly MP services to satisfy both functional and emotional needs of users, such as designing high quality MP systems, reducing operation steps, as well as making the technological interfaces visually attractive. In the promotion campaign of MP services, besides providing functional and emotional features, providers should also consider whether consumers could get monetary benefits or rewards for their transactions. One possible way is to make competitive pricing strategies, such as a relatively lower price or discounts to promote MP adoption. Second, our result shows that consumers’ value perceptions are rather dependent on their emotional trust. Thus, the traditional perspective of only enhancing cognitive trust for MP adoption appears to be insufficient. We suggest that service providers should further allocate their trust-building resources strategically to consider and improve emotional trust of consumers.

Limitations and Future Research
This study also has several limitations and opportunities for future research. First, this study uses a convenient sample of university students and faculties to test our hypotheses. To increase the generalizability of the findings, future researchers may consider enlarging the sample size or applying the research model in different regional settings. Second, this study focuses on investigating the separate effects of cognitive and emotional trust. We show that the two factors will facilitate intention to use MP by increasing consumers’ value perceptions differently. Future research is then encouraged to shed light on exploring the determinants of cognitive trust and especially emotional trust. According to McKnight [37], there are several underlying mechanism to build initial trust, including knowledge-based mechanism, trust transfer mechanism and institution-based mechanism. Future studies may consider these trust building mechanisms to develop consumers’ cognitive and emotional trust in MP. It will be interesting to discern which mechanism is more appropriate for building cognitive trust and which is more suitable for building emotional trust. Finally, we recognize that the impacts of cognitive and emotional trust on value perceptions may not be totally independent from its context. Recent research posits that the outcomes of consumers’ trust may vary under different online institutional structures [6; 11]. Thus, we encourage future research to consider such issue and extend our findings.

REFERENCES


*The Fifteenth International Conference on Electronic Business, Hong Kong, December 6-10, 2015*


COMPARING ONLINE CONSUMERS' BRAIN IMAGES IN DIFFERENT PURCHASING-DECISION PROCESSES

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Fang-Ning Chang, National Cheng Kung University, Taiwan, changfn.af@gmail.com

ABSTRACT
Since 1991 researchers from different disciplines have begun using functional magnetic resonance imaging (fMRI) to explore the brain which influences behavioral economics and controls positive and negative emotions that influence financial decisions. fMRI uses the blood-oxygen-level dependent (BOLD) contrast to determine different levels of neural activities. Prior studies have used fMRI to investigate the brain’s neurons for predicting consumers’ behavior. The results consistently show that product preference correlates with activation of the nucleus accumbens (NAcc), while the medial prefrontal cortex (MPFC) activates according to price differential. Reportedly, NAcc has involvement in producing an appropriate behavioral response in risky or disadvantageous situations. In addition, greater activity in the insula associates with non-purchases. The BOLD signal in NAcc, MPFC, and insula are, apparently, strongly predictive of the decision to purchase. In addition, prior studies of brain imaging related to brands have significant impact. Specifically, the ventromedial prefrontal cortex (VMPFC), hippocampus, dorsolateral prefrontal cortex (DLPFC), and midbrain can predict preferences for branded products. However, the location of activated neurons in different areas of the brain due to online consumers’ perspectives for different brands of used products (or second-hand products, SHPs) remains unknown. Thus, the purpose of this study is to verify the activated neurons when decision-making occurs during consumers’ participation in online auctions to determine perspective toward brands when purchasing second-hand products (SHPs) and new products. This study recruited 12 participants to enter the fMRI experiment which contains 80 images, including 40 SHPs and new products and 40 brand and non-branded products for making purchasing and/or non-purchasing decisions. Before the experiment, a short survey assists determining the participants’ brand perspectives. As result, this study finds activation of the medial prefrontal cortex (MPFC) is significantly different when online consumers purchase SHPs as compared to purchasing new products. Further, purchasing SHPs apparently correlate with activation of the insula. Also, the consumers’ dorsolateral prefrontal cortex (DLPFC) activates significantly during online purchasing of branded products. However, ventromedial prefrontal cortex (VMPFC) displayed insignificant activation due to consumers’ preferences for certain brands. This study has provided both theoretical and practical implications. This study’s results are also critically useful for brand management.

Keywords: Online consumer decision, brand perspectives, second-hand products (SHP), functional magnetic resonance imaging (fMRI)

ACKNOWLEDGEMENTS: We thank Mind Research and Imaging Center (MRIC) at National Cheng Kung University for consultation and instrument availability. MRIC is supported by the Ministry of Science and Technology.
CONSUMER BRAND ENGAGEMENT: ROLE OF GAMIFICATION
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Elena Vitkauskaitė, Kaunas University of Technology, Lithuania, elevitk@ktu.lt

ABSTRACT
Gamification became a new attractive way to strengthen relations with consumers for companies and brands. Despite gamification is new and not clearly described phenomena companies apply different gamification techniques aiming to enhance consumers brand engagement. The paper explores gamification concepts and gamification techniques, successful gamification characteristic and gamification impact on different engagement dimensions. The proposed gamification impact on consumer brand engagement is tested empirically.

Keywords: Gamification, Game mechanics, Game components, Flow, Engagement.

INTRODUCTION
Gamification phenomena is gaining attention from practitioners and researchers. Gamification was identified as perspective technology by Gartner [16] [17] for several last years. This caused growing number of research and solutions aiming to explain gamification from various perspectives. Companies apply gamification in various activities such as user engagement, motivation, education of consumers and employees, innovation management, and personal development [17].

Gamification relates to game thinking application for companies activities in non gaming context [11]. According Gartner [17] gamification can be applied in consumer engagement, consumer and employs education, innovation management, personal improvement and others. The recent research of gamification demonstrates that gamification facilitate intrinsic motivation [12], participation [35] [33], creates better experience for consumers [14] [18]. These gamification benefits leads to long lasting relations establishment with consumers.

Consumer–brand engagement is a recent concept in the marketing literature [32]. Practitioners conceive consumer brand engagement as establishing a strong and enduring bond between brand and consumers based on an ongoing effort of the brand to activate consumers through interaction, shared values, experiential contents and rewards [30] [15].

The aim of the article is to develop gamification impact on consumer brand engagement model and empirically test it in Lithuania market. In order to achieve this aim paper will analyze gamification definition and gamification elements, flow concept and consumer brand engagement concept. Basing on literature review the research model is established and empirically tested in Lithuania market. Research method: systemic and comparative analysis of the scientific literature was applied when developing the theoretical analysis, empirical data were collected through consumer survey.

This paper will extend the gamification impact on consumer brand engagement literature by integrating gamification, flow and consumer brand engagement constructs.

GAMIFICATION CONCEPT
Gamification and Game Elements
Despite growing attention to gamification as a new concept suggesting innovative approach to costumer relationship development, different elements of gamification have been used by companies for long time. Gamification deployment in physical market was complicated and ICT development created favorable preconditions for wider gamification used between various organizations. As gamification is relatively new phenomenon different approaches what is gamification can be found in academic and practical literature. One of the first definition of gamification were proposed by Deterding et al. [8]. Deterding et al. [8] suggested that gamification is based on use of gamefulness, gameful interaction, and gameful design for the specific purposes. Huotari and Hamari [24] suggested not to follow approach proposed by Deterding et al. [8] stating that gamification of activities is different from the full-fledged game. The authors recommend focusing on the user experience, regardless of what form gamified service or activity takes. According Werbach and Hunter [34] companies should develop products, services and systems from the game developer's perspective. Considering this Werbach and Hunter [34] define gamification as the adoption of game elements and game development techniques in a non-game context. Considering various researchers' perspectives broadly gamification can be defined as use of game elements (game mechanics, game dynamics and game components) in non-game context and in daily situations which are not related to games.

Another important direction in gamification research is attempt to provide systematic approach defining different elements and their interconnections. Typical practitioners approach to gamification is based on points, badges and leaderboards (so called PBL approach). Deterding and others [10] proposed game development taxonomy identifying five main components for gamification. As alternative practitioners suggested various frameworks enabling gamification of companies’ activities – such as Octalyst framework [3], Gamification 2.0 framework [27], Gamification canvas [26].
However, the most widely accepted gamification framework is Werbach and Hunter [34] proposed gamification pyramid:

- Dynamics encompasses the big picture aspects of a gamified system. At the top of the pyramid, they are the most high-level conceptual elements in a game or gamified system.
- The second group of elements is the Mechanics. These are the basic processes that drive users to engage with the content and continue to drive the action forward.
- Components make up the largest group of game elements. In many ways the components are more specific form of either Dynamics or Mechanics. These elements are less abstract than the first two categories and lead to actual tools that can be employed to begin to incorporate gamification in the environment of interest.

The main game dynamics, game mechanics and game component elements identified by Werbach and Hunter [34] are provided in Figure 1.

![Gamification pyramid and most widely used game elements](image)

**Gamification and Flow**

For the companies applying gamification is important to understand if gamification applied successfully. Typically, this assessment is made on consumers behavior, however video game theory successful game associate with flow. Csikszentmihalyi [5] proposed flow definition defining flow as a state of concentration or complete absorption with the activity at hand and the situation. It is a state in which people are so involved in an activity that nothing else seems to matter^2. Flow is characterized by challenges and skills balance otherwise user will experience boredom or anxiety.
Csikszentmihalyi [5] identify nine important flow characteristics:

- Clear objectives
- Immediate feedback
- Equilibrium between the level of challenge and personal skill
- Merging of action and awareness
- Focused concentration
- Sense of potential control
- Loss of self-consciousness
- Time distortion
- Autotelic or self-rewarding experience

According various researchers and practitioners flow is important construct in gamification research [1], [7], [19], [20], [34]. Flow can be interpreted as mono-dimensional or multidimensional construct. Researchers interpreting flow as mono-dimensional treat flow as independent construct as well as constructs of antecedents and gamification results. There are several attempts to develop gamification flow measuring scale. However, Hoffman and Novak [21] suggested to analyze flow as multi-dimensional construct and proposed that every dimension of flow should be measured independently.

In our research we consider flow as characteristics of successfully gamified companies activities and interpret it as mono-dimensional construct.

**CONSUMER BRAND ENGAGEMENT**

Gamification often is applied to increase consumers engagement in order to create long lasting relations. Hollebeek [22] defines “customer brand engagement” as “the level of a customer’s motivational, brand-related, and context-dependent state of mind characterized by specific levels of cognitive, emotional, and behavioral activity in brand interactions.” Javornik and Mandelli [25] identified four perspectives for the main research streams of the customer engagement in the academic literature:

- Behavioral perspective;
- Psychological (cognitive and affective) perspective;
- Multidimensional perspective;
- Social perspective.

Cognitive, emotional and behavioural dimensions are most commonly identified in scientific literature related to consumer engagement studies [22], [23]:

- Cognitive dimension: consumer’s level of engagement object related through processing, concentration and interest in specific object (business enterprise, brand, online social network, brand community);
- Emotional dimension: a state of emotional activity also known as the feeling of inspiration or pride related to and caused by engagement object.
- Behavioural dimension: a state of consumer behaviour related to engagement object and understood as endeavor and energy given for interaction.

Considering the virtual environment, it is important to note that the experience of consumer gains an important role. According to Calder et al. [2], the fundamental insight is that engagement comes from experiencing a website in a certain way. As typically companies use websites, social networking platforms or applications to deliver gamified activities, consumer experience in using these tools refers to consumer engagement. According to Calder et al. [2] online consumer engagement can be understood to its fullest only after a thorough examination of different experiences that the consumer gets during the interaction with the site, social networking platforms or application.

From the point of gamification consumer experiences could be created and delivered through different game elements and game elements combinations. Robson et al. [29] suggested that gamified experience can be analyzes through participation and connection perspectives:

- Participation (active vs passive) perspective. Player participation describes the extent to which the individual is either passively involved in the experience or actively contributes to it.
- Connection (absorbed vs immersive) perspective. Player connection describes the type of environmental relationship that unites the individual with the experience. In absorption, the experience unfolds before the person and occupies the person’s mind, whereas in immersion a person becomes part of the experience itself.
The gamified engagement is important as cording to Fischer [13], engaged consumers tend to bring together a group of other consumers that has identical or very similar interests. The engaged consumers are tend to become loyal consumers, act as company advocates and more actively participate in various company’s initiatives.

**RESEARCH MODEL**

The research aims to test the impact of gamification on consumer brand engagement. Based on literature review, it is assumed that successful gamification of business activities would lead to Flow state. It is also assumed that consumers who get into Flow state are likely to have higher brand engagement. Research model was constructed following these assumptions (see Figure 2).

![Figure 2. Conceptual research model](image)

A quantitative research approach is fitting to achieve above mentioned research aim, therefore, the quantitative online survey method was selected for primary data collection. Survey covered wider array of questions but only aspects related to above presented research model will be discussed in detail in this paper. The questionnaire was developed based on the nature of information needed and thus it was made of multi-item 5 point rating scales ranging from 1 – “completely disagree” to 5 – “completely agree”. For gamification two separate scales were employed to cover game mechanics and game components. Scale for measuring game mechanics consisted of 7 items and scale for game components consisted of 5 items, both developed based on findings of literature review (see summarized in Figure 1). Game elements of game dynamics level are not covered in this research as those game elements are invisible to consumers therefore impossible to asses by surveying them. Flow state is treated as a mono-dimensional construct and the scale for measuring it includes 7 items: 5 items adopted from Choi and Kim [3] 6 item scale and the last item was replaced by 2 items from Rheinberg, Vollmeyer ir Engeser [28] short Flow scale. The scale for consumer brand engagement includes 11 items, adapted from So, King and Sparks [31] and Hollebeek, Glynn and Brodie [23]. Three items of this scale reflect the cognitive brand engagement dimension, five items cover emotional dimension and remaining three items represent behavioral dimension. Testing with Cronbach alpha coefficients showed high internal consistency of developed scales. People, who were engaged in some business activities through gamification anytime in the past six months, were the population of interest for this research, but no specific brands or activities there indicated to respondents. The respondents for this survey were selected by non-probability convenience sampling method.

**EMPIRICAL RESEARCH RESULTS**

Answers from 749 respondents were received in the online survey. Less than half of them (46.3 %) stated they were engaged in some gamified business activities though. Therefore, data analysis and the research findings are based on data from 347 respondents. Females were dominating (about 75 %) among respondents, and more than 62 % of respondents were of age between 26 and 35 years old (see Table 2).

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>87</td>
<td>25,1</td>
</tr>
<tr>
<td>Female</td>
<td>260</td>
<td>74,9</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25 years or younger</td>
<td>69</td>
<td>19,9</td>
</tr>
<tr>
<td>26–35 years</td>
<td>216</td>
<td>62,2</td>
</tr>
<tr>
<td>older than 35</td>
<td>62</td>
<td>17,9</td>
</tr>
</tbody>
</table>

Descriptive statistics analysis of attractiveness of game elements is summarised in Tables 3 and 4. Survey participants find gamified business activities having the development function, motivating to explore, acquire knowledge, and develop (Table 3). The least attractive to survey respondents are gamified business activities encouraging them to collect.
In respect to game components, survey respondents evaluated levels and points as the most important ones, which partly matches the PBL referred to as game elements used most often for gamifying business activities. The importance itself is lower than four on five point scale tough, but the importance of each game component was rated higher on average than the 3 points representing neutral attitude (see Table 4).

First research model assumption of gamification leading to Flow state was checked by analysing correlation between gamification and Flow state. Results of this analysis prove positive statistically relevant relation between these constructs though relation is of average strength (see Table 5).

Before checking the second assumption of research model, it is worth to overview the measures of consumer brand engagement (see Table 6). Analysis of descriptive statistics presented in table shows that overall consumer brand engagement is relatively low. Survey respondents on average evaluated items related to cognitive engagement most positively. Emotional engagement was evaluated on average nearly as high, meanwhile items of behavioural engagement were evaluated rather negatively.

Regression analysis was applied to check flow impact to consumer brand engagement. Flow state was used as independent variable and consumer engagement as dependent variable. However, determination coefficient $R^2 = 0.096$ of regression model ($F(1,326) = 34.650; p < 0.000$) is way smaller that recommended minimal interpretable value ($R^2 < 0.2$). Therefore, for this research assumption of consumers achieving Flow state, while participating in gamified business activities, more likely engage more with brand was not supported by evidence.
In order to explore direct relations between gamification and consumer engagement, without mediation impact of Flow state, correlation analysis was performed. Correlation between the combined constructs of gamification and consumer engagement have weak positive significant relation ($r = 0.255, p < 0.001$). Both game mechanics and game components were found to be positively related with consumer engagement ($r = 0.202, p < 0.001$ and $r = 0.237, p < 0.001$, respectively), though the relation found was weak. Correlation between separate game gamification and consumer engagement dimensions was found to have positive, but weak relations (see Table 7). The strongest relation was found between gamification and cognitive engagement ($r = 0.275, p < 0.001$), and the weakest – between gamification and behavioural engagement ($r = 0.173, p < 0.001$). Thus overall assumption of research presented in this paper of gamification positively impacting consumer brand engagement can be confirmed. However, the relation between those constructs is weak and game components are found to have a little bit stronger relationship with consumer brand engagement and dimensions of it compared to game mechanics.

**CONCLUSIONS**

Gamification is an increasingly popular mean to establish better relations with consumers and develop consumer engagement. Gamification can be defined as use of game elements (game mechanics, game dynamics and game components) in non-game context and in daily situations which are not related to games. There are several approaches to develop gamification elements systems, but the most popular one is Werbach and Hunter proposed gamification pyramid approach. Gamification pyramid concept defines key game element types- game dynamics, game mechanics and game components.

Gamification is treated as successful mean to facilitate consumer brand engagement. Consumer brand engagement is considered as multi-dimensional construct defined through three dimensions – cognitive, behavioral and emotional. Gamification created engaged experience which leads to beneficial consumer behavior towards company.

Literature review suggest gamification impact on consumer brand engagement model. Gamification construct is defined through game mechanics and game components. Successful gamification leads to flow and flow results in higher consumer brand engagement.

These assumptions were empirically tested with online survey in Lithuanian market. The data collected supports only part of assumptions. Gamification was found to have a significant relationship to Flow state, though of average strength. Positive relationship was also found between constructs of gamification and consumer brand engagement, though relationship is found to be weak. However assumption of Flow state to have positive impact to consumer brand engagement was not supported by evidence.

**REFERENCES**


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CREATING VALUE BY OBJECT HYPERLINKING ALONG THE CONSUMER BUYING DECISION PROCESS IN THE IOT ERA

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ABSTRACT
Within the IoT scope, a new application named ‘object hyperlinking’ has evolved. Object hyperlinking is the pervasive presence of different things or objects identified by tags, sensors, and mobile phones that can interact with each other as well as with their neighbors through unique addressing schemes for business purpose. Enabled by Automatic Identification and Data Capture (AIDC) technologies such as QR code and NFC, object hyperlinking services make it possible link any object or location to a more comprehensive and editable information. While tagging technologies have good prospects to offer more opportunities in a company’s interaction with its consumers, how this capability can be best applied and what innovative business services be created with object hyperlinking remain to be discovered. This study surveys and examines 76 projects of object hyperlinking in Taiwan and provides a framework to figure out business value and issues of object hyperlinking along the five stages of a consumer buying decision process. Based on the functionality and purpose of object hyperlinking services, this framework is conducted in dimensions of value creation, value orientation, functionality, key factor and challenges, key activities within organization, and managerial issues concerned. Some innovative business models enabled by object hyperlinking will also be introduced. The research results found that only when the information gathered by identified objects is used, analyzed, and distributed into wide business activities in term of marketing, customer service and firm level strategy planning, the effectiveness and value of object hyperlinking services can be realized at its maximum. The integration across different consumer buying decision process is also important. The more applications of object hyperlinking in different buying decisions, the more benefits will be created for customers. Managers can use the list of dimensions proposed in the framework to develop rich IoT business from enhancing service operations with object hyperlinking.

Keywords: Object hyperlinking, Internet of things, consumer buying decision process, AIDC, value creation.

INSTRUCTION
The growing availability of open wireless, actuator nodes, and tagging system embedded in mobile devices present lots of opportunities to improve business processes as well as to enable new service [1], [2]. Such ubiquitous identifiers and connectivity lead to a new scenario, the Internet of Things (IoT). Today, IoT has stepped out of its infancy and is on the verge of transforming the static Internet into a fully integrated one [7]. All objects, people or animals, physical or digital, are all converged in IoT, allowing firms to dynamically generate, analyze, and communicate intelligence data, increasing operational efficiencies, and powering new and greatly improved business models [4]. This offers the ability to measure, infer and understand environmental indicators, from delicate ecologies and natural resources to urban environments [7]. The idea of extending the Internet to the real world creates a new application named ‘Object Hyperlinking.’ A ‘hyperlinking object’ can represent itself digitally to become something greater than the object itself. Object hyperlinking can be seen as one of the key part of IoT which emphasizing creating data by things (objects) rather than by human being through embedded sensor and actuator nodes.

Transactions via object hyperlinking are service-oriented, facilitating a flow of information that enhances service execution [9]. However, most academic literature concerning tagging system has concentrated on technical issues, and the literature examining the business side focuses mainly on very specific topics [1], [2]; lacking a well-rounded view of the managerial issues concerning related services enabled by tagging system. Thus, the purpose of this study is to provide a holistic view of the applications and managerial issues affecting the deployment of object hyperlinking services utilizing Automatic Identification and Data Capture (AIDC) technologies. With such analyses, we hope to create better understanding on how successful, full-scale implementations of new mobile services can be accomplished in the IoT era.

Also, even lots of applications of object hyperlinking have emerged in reality. Object hyperlinking has not been listed as a critical service research topic yet. As such, service management researchers still are in need of theoretical foundations and comprehensive frameworks for subsequent empirical works. In light with this, this study has created a framework based on a consumer buying decision process to discover and illuminate key issues that will face practitioners as they approach business opportunities resulting from object hyperlinking. We have considered these issues along the dimensions of value creations, value orientation, functionality, and managerial concerns of implementing object hyperlinking services. In conducting the analyses, we also noted some issues persist during the implementation, particularly in the case of the need of integration along the buying process and across different business activities.

By analyzing 76 projects of object hyperlinking supported by a subsidy program of Taiwan government and conducting a comprehensive framework of object hyperlinking service, this study contributes to practice by identifying what kind of services AIDC technologies can provide to increase business value. The framework helps demonstrate the breadth of opportunities available to managers to adopt object hyperlinking enhanced service and applications.
LITERATURE AND RELATED CONCEPTS

The use of mobile devices and AIDC technologies to link physical objects in the real world to the digital one has impacted several models like object hyperlinking. Related concepts are described in this section. The five stages in a consumer buying decision process are also introduced.

Internet of Things (IoT) and Object Hyperlinking

The IoT concept defines a paradigm to identify and communicate with smart objects. In other words, IoT describes a world that physical objects can be connected to the Internet and be able to identify themselves to diverse devices [2], [4]. Given the advanced connectivity of open wireless technologies, interconnected objects not only can generate information from the environment (by sensing) and interact with the physical world (by actuating / commanding / controlling), but also provide services for information transfer, analyses, applications and communications [7]. Seamless and large scale sensing, smart connectivity, context-aware computation, advanced big data analytics and information representation are all taking the potential value of IoT applications and services to a whole new era [7]. The term, ‘Internet of Things,’ shows the most key words in the IoT world, Internet and things. However, Atzori et al. [2] had proposed that an IoT vision can be realized not only by ‘Internet-oriented’ and ‘object-oriented’ paradigms but equally important by a ‘semantic-oriented’ paradigm. ‘Semantic oriented’ IoT focuses issues related to the methods of representing, storing, interpreting, and organizing information generated in IoT [2], [19].

Focusing on the ‘thing-oriented’ aspect and the communication and linking among things (An object is not necessary linking to the Internet), a phenomenon called Object Hyperlinking is emerged. Object Hyperlinking is based on the idea of IoT that the pervasive presence of different things or objects identified by tags, sensors, and mobile phones can interact with each other as well as with their neighbors through unique addressing schemes to reach common goals [2]. Like digital hyperlinks on web pages are linked to information on the Internet, object hyperlinking is the link of objects in the physical world to the information in the digital space. “Object Hyperlinks transform physical media into live links for accessing information and entertainment online.” [5]. Enabled by Automatic Identification and Data Capture (AIDC) technologies such as QR code and NFC, object hyperlinking services make it possible link any object or location to a more comprehensive and editable information. AIDC is the method that using tagging technologies to identify objects, obtain data from objects, and enter that data directly into computer systems without little human involvement [20]. AIDC techniques provide fast, easy and accurate data collection methods. People can use the data collected for other purpose such as for analysis or distribution. These technologies are used not only for facilitating data entering, but also for allowing interactions with people, places and things with the mobile devices which in turn enhancing the usability and usefulness of these devices [20]. Lots of tagging technologies are considered as AIDC techniques, such as bar codes, Radio Frequency Identification (RFID), biometrics, magnetic stripes, and voice recognition. However, linking an object or a location to the digital world is a more involved process than linking two web pages [15].

Consumer Buying Decision Process

The five recognized steps of a buying decision process are problem or need recognition, information search, evaluation of alternatives, purchase, and post-purchase behavior [11]. This means that there are five key points at which sales and marketing teams and their efforts can either win or lose sales for a company [18].

1. Need / problem recognition: A problem or need recognition always arises when there is a gap between the current state of affairs and some ideal and desired state. A consumer’s need may be triggered by internal or external stimuli [11]. Internal stimuli are physiological needs perceived by a consumer such as hunger or thirst [16]. Consumers may be also stimulated by external stimuli such as exposure to an advertisement and a need of something is then emerged [8]. (2). Information search: A consumer may seek to make her/his opinions to guide his choice and his decision-making process with internal or external information. Internal information is the information that already collected earlier and stored in a consumer’s memory. It comes from previous experiences a consumer had with a product or brand and the opinions she/he may have of the brand. But when it comes to a major purchase with a level of uncertainty or stronger involvement, internal information is usually not enough in the search for appropriate data [8], [16]. External information is related to a product or brand received from external source. Sources of external information include personal, public, experiential, and commercial sources [8]. However, not every search of a consumer is purposive and some search could be just for fun or interesting. (3). Alternative evaluation: Once the information collected, a consumer will be able to evaluate the different alternatives that offer to her/him, involving examination and comparison of product attributes [8]. All the alternatives a consumer knows are called an ‘evoked set’ and the ones that are actually being considered are the ‘consideration set’ which is mostly just a comparable small number of the evoked set [13], [14]. (4). Purchase decision: Factors such as past shopping experience or store atmosphere, promotion provided, extent of purchase involvement, and return policy will affect a consumer’s final decision [17]. In this stage a consumer not only decides what to buy, but also determines when to buy and where to buy. The purchasing decision depends also very much on the level of involvement of a purchase. (5). Post-purchase behavior: Post-purchase evaluations may have important consequences for a brand, given that a satisfied customer is very likely to become a loyalone.

METHOD

Qualitative method was adopted and projects surveyed were based on a big government subsidy project executed by Taiwan government. It was a 4-years program began in 2011 and finally 77 projects got the subsidies from government (one of the project
A FRAMEWORK OF OBJECT HYPERLINKING SERVICE

Analysis Dimensions of Object Hyperlinking Services

After surveying and examining 76 projects of object hyperlinking services, we conducted a framework to figure out the business value, issues and managerial concerns of object hyperlinking along the five stages of a consumer buying decision process. The conducted framework was divided in dimensions including value creation, value orientation, functionality, related tagging technologies, and managerial concerns (issues concerned, key factors and challenges, and key activities within organization) along the buying process. Some innovative applications of the 76 projects enabled by object hyperlinking are also introduced.

I. AIDC technologies: The 76 projects used a wide range of tagging technologies, including QR code, bar-code, RFID, Biometric, GPS, iBeacon/Beacon, NFC, image recognition, voice recognition, and sound wave. The most adopted AIDC technologies are QR code and RFID. In the final two years of the subsidy program, there was a trend that firms used QR code to replace RFID in their projects as the e-tickets of movie, baseball game or amusement parks. Given that graphical tags require low cost and are easy to implement and produce than physical tag like RFID, it is these graphical tags that are of particular interest to object hyperlinking services today.

II. Identified object: As the Ashton said: “If we had computers that knew everything there was to know about things - using data they gathered without any help from us - we would be able to track and count everything, and greatly reduce waste, loss and cost.”[1] For different roles, being it product/service providers or consumers, the things or objects need to be discovered are various. We found the identified objects in the 76 surveyed projects including people, place, product, and service. (1). People (by biometric verification): The most important people a firm interested are undoubtedly the customers or potential customers. In one of the projects, a firm used biometric technology to identify its customers’ face and provided recommendations of skin care products according to a customer’s sex, age, and face conditions. (2). Place (by GPS, or iBeacon): Using GPS technology, one project identified a customer’s location in a golf course and push value-added information in terms of weather, shape topography, and playing tactics to the customer’s mobile phone. (3). Products (tagged with QR code, RFID): Tags are embedded in a product and consumers can scan the tags with mobile devices to get more information about the products. In many surveyed projects, QR code was included on products for linking to additional valuable information, e.g., videos, product certifications or spec sheets. (4). Service (by QR code, RFID, AR, iBeacon, NFC etc.): The ‘object’ interested in these applications is not a person, place, or location, but rather the service itself. Tags were used as e-tickets, certifications, reward points, or a bank account.

III. Value creations and value orientation: 4 value categories firms hope to create by object hyperlinking service in different buying process are figured out. (1). Automating transactions / operational-orientation: Firm provide services such as e-payment, e-passport or e-authorization for automating a transaction. This value is more operational-oriented and can easily be realized by firms with little implementation risk and strategic value. (2). Facilitating transactions / information-orientation: The link from an offline object to an online website or APP, firms assist consumers to easily evaluate product/service attributes like the features and functionality. By AIDC techniques, firms can also provide complete product information, such as product traceability or certifications to increase the information visibility of a transaction and reduce consumers’ searching efforts. In other words, object hyperlinking can facilitate the process of information search and alternatives evaluation by reducing time and effort required. By so doing, object hyperlinking can further enable consumers to buy directly from the landing online pages. (3). Stimulating needs / marketing-orientation: With context aware computing, object hyperlinking can also help marketing persons to stimulate a consumer’s needs by accurately identifying a consumer and the place she/he located. Firms can provide context-dependent information or advertisement accordingly to trigger a consumer’s aware of desired need and boost further transactions. Some projects provided location relevant promotion or coupon with GPS and iBeacon tagging system. (4). Increasing customer loyalty / service-orientation: This sub-dimension aims to enhance customer loyalty, satisfaction, and better service experience by object hyperlinking. Some projects use tags as the certification of reward points in their loyalty program. Some projects combine object hyperlinking service with company APPs and provide value added service. In the project of a pharmacy, uses can get more drugs information by scanning a QR code on the drug bag to login to an APP. The pharmacy APP would remind the user when and how to have the drug on the right time in a right way.

A Framework of Object Hyperlinking along a Consumer Buying Decision Process

Object hyperlink can be used to help firms enhance their sales effectiveness and in the different stages of the buying cycle. Here, we identify the range of possible applications practitioners are likely to confront in fully applying object hyperlinking. In order to examine the challenges and opportunities for practitioners in object hyperlinking, it is useful to follow the process a consumer making decision for choosing a product or brand that seems most appropriate to her/his needs. Details regarding of object hyperlinking services at each stage of buying process on each dimension are presented in Tables 1 and 2.
Table 1. A Framework of Object Hyperlinking

<table>
<thead>
<tr>
<th>Value Dimensions</th>
<th>Functionality</th>
<th>Tagging Technologies</th>
<th>Service Examples in the Projects</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Value Creation:</strong> Stimulating needs</td>
<td>- Providing recommendation, guide, game, or advertisement to boost further transactions, such as recommending location-based service or coupon. - Providing ‘audience-targeting’ advertisement or coupon by biometric verification. - Scanning QR code via a unique reading APP, a consumer can get special coupons or discount which may trigger a further buying behavior.</td>
<td>QR code, RFID, Biometric, GPS, NFC, iBeacon / Beacon, image/sound/video recognition (image matching)</td>
<td>- Using incentives to attract customer participate in a map-based game. QR code was printed in the poster in key traffic stations and consumers can get reward points and some incentives by finishing the requirements in the game hyperlinked via QR code. - In a project implemented by a well-known coffee chain, consumers can buy QR Code based electronic coupons through an APP developed by the coffee chain. The QR Code can be then transferred through the phone to someone else who can use the code for exchanging a cup of coffee. With a sharing mechanism, a consumer would be trigged for buying more cups of coffee when she/he enters into a coffee shop.</td>
</tr>
<tr>
<td><strong>Value Orientation:</strong> Marketing-orientation: Changing consumers from awareness to interest</td>
<td>- Providing object-centered information, such as product traceability, certifications, and location-based information. - Making information search easier and quicker via AIDC techniques.</td>
<td>QR code, RFID, iBeacon / Beacon, GPS, AR</td>
<td>- A magazine advertisement or point-of-purchase sign can generate awareness of the new product, and then a QR code can link an interested consumer to a video or analysis that provides more information. In a project, a demo of product operation, a scientific expert’s view of the product, and user review were available for customers by QR code connection. This is an efficient way to educate consumers about highly innovative or technical products. - In a project, the object hyperlinking service provided a platform for anglers to exchange or sale fresh fish. By scanning a QR code in the fish market, consumers can link to the website for information about a fresh fish, including landing sites, anglers’ presentation, processing time, delivery time, nutrients, recommend cooking methods, and other information.</td>
</tr>
<tr>
<td><strong>Value Orientation:</strong> Information-orientation: Assisting consumers to gather information efficiently</td>
<td>- Providing detail and comparative attributes of alternative stores or products, such as product test reviews or experience reports by scanning an QR code. - Trying to influence an alternative evaluation and move a particular product from an ‘evoked set’ to a ‘consideration set’. - Facilitating evaluation processes by hyperlinking into a well-design APP</td>
<td>QR code, RFID, GPS, iBeacon / Beacon, Biometric</td>
<td>- Providing easily way for product comparison in various attributes by connecting tags to an APP or website. - Using iBeacon technology, a professional hardware manufacturer developed an object hyperlinking service by providing most recommended or best buy products list around an individual’s position in an outlet. - Combined with QR code, RFID, and GPS technologies in the project, a shoe chain provided personalized service by recommending product mix for assisting purchasing choice of shoes. - Adopting QR code technology, a pharmacy provided stock and detail drug information for its customers. If customers provide health condition, the APP will recommend a mix of goods according to the health status of the customers.</td>
</tr>
</tbody>
</table>
### Value Dimensions

<table>
<thead>
<tr>
<th>Value Creation:</th>
<th>Value Orientation:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automating transactions</td>
<td>Transaction-orientation: Making transactions easier and safe</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Value Creation:</th>
<th>Value Orientation:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increasing customer loyalty</td>
<td>Service-orientation; information-orientation</td>
</tr>
</tbody>
</table>

### Functionality

- Providing safe and convenient payment.
- Using actuator nodes, and tags as passports or authorization, such as transportation pass and e-ticket.
- Managing and exchanging reward points easily by tagging system.

### Tagging Technologies

- Sound wave, QR code, RFID
- QR code, RFID, GPS, NFC, AR

### Service Examples in the Projects

- Several projects integrate RFID and QR code with POS devices for payment and reward points management.
- In some projects, consumers can scan the QR code on the product package in the outlet to order related product immediately.
- A travel agent used RFID technology to integrate various vendors such as attractions, restaurants, hotels, transportation to provide Taiwan-specific tourism package. All the certifications and tickets were available online and then were stored in an APP with RFID tags after online ordering.

- Positioning with GPS and Wi-Fi, a professional baseball team provided its fans interactive information about the players and real time analysis of the game. This service enhanced interaction and repurchase intention of the fans. Fans can scan the QR code printed on the baseball game tickets after the end of game. The QR code will redirect to an APP of the fan’s selected team to get rewards points. The rewards points can be used to exchange team posters or products and the loyalty of the fans might be strengthened.

- Added QR code to the product package and linking customers to a website with useful resources – like customer service phone numbers or user manuals.

- By integrated with electronic payment, a project provided an APP to the users for shopping records management and budget planning.
I. Need recognition: Need recognition is considered as the most important aspect in a purchasing process since a consumer does not perceive a problem or need, she/he generally will not move forward with considering a product purchase. Object hyperlinking can play as an external stimulation to trigger a consumers’ need, creating a marketing-oriented value. In this stage, firms identify objects (e.g., people or place) and the context an object embedded. Firms then adopt customized actions to response to the context awareness. A famous example is the object hyperlinking application of E-mart. E-mart is the largest retailer in South Korea and had introduced an innovative Sun-based QR code which would only be revealed between 12 pm and 1 pm. Every day the sale in the form of special offers, coupon downloads and other promotions were different by the connection of QR code. The final results were excited that sales during lunch time by a whopping twenty five percent increased [3].

II. Information Search: In this stage, firms can create value to their customers by facilitating transaction with easier information accessibility and more complete and structured information. Therefore, object hyperlinking services providing information-orientation services to consumers. Taking an example, firms can offer object-centered information like product traceability, certifications, location-based information and so on.

III. Alternative evaluation: Similar to information search stage, object hyperlinking services facilitate the process of alternative evaluation and offer information-oriented value to consumers. By read the embedded sensor and actuator nodes, individuals can access detail and comparative attributes of alternative stores or products, such as product test reviews or experience reports and the alternatives in the evoked set may be decided.

IV. Purchase decision: In this process, object hyperlinking services help consumers finish transactions automatically in a more quick and convenient way. Payment and transportation tickets are common applications adopted in this decision stage. This is a transaction-oriented service. It is better to combine tags with online services to bring consumers from online to offline (O2O) and quickly complete the purchase with AIDC technologies. To smooth the transaction, the data generated by tags must be integrated with other enterprise system such as ERP system to make the data generated consist and accurate.

V. Post-purchase behavior: Firms try to provide value added and interactive services to customers in this stage. Both service-oriented value and information-oriented value are offered to increase customer loyalty. Firms may use customer behavior analysis and relationship management program to improve purchase experience of their consumers.
Table 2. Managerial Concerns of Object Hyperlinking

<table>
<thead>
<tr>
<th>Managerial Issues Concerned</th>
<th>Key Factors and Challenges</th>
<th>Key Activities within Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Need Recognition</strong></td>
<td>- The qualified and relevant recommendations and customized ads.</td>
<td>- Data collection, analysis, and applications</td>
</tr>
<tr>
<td>- Context aware: How accurate and effective a stimulus can be offered after identifying an object?</td>
<td>- Technology and method to sense the context dynamically of an object.</td>
<td>- Context aware computing.</td>
</tr>
<tr>
<td>- Cross-selling: align with other brands to increase the perceived benefits of users.</td>
<td>- Applying big data and data mining technologies</td>
<td>- Marketing (especially promotion)</td>
</tr>
<tr>
<td>- Offline to Online: Combining with other online services to let an offline customer have motivations to make transactions online soon.</td>
<td></td>
<td>- Strategy planning</td>
</tr>
<tr>
<td>- Novel marketing for enhancing consumers’ motivation to use tagging technologies</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Information Search</strong></td>
<td>- Providing value added (e.g., comprehensive, useful, and real time) information.</td>
<td>- Marketing</td>
</tr>
<tr>
<td>- Information collection, analysis, representation, and accessibility</td>
<td>- The accessibility of information and systems (e.g., ease of use).</td>
<td>- IT (APP design)</td>
</tr>
<tr>
<td><strong>Alternative Evaluation</strong></td>
<td>- The usefulness and convenience of Apps in helping evaluating alternative.</td>
<td>- Marketing</td>
</tr>
<tr>
<td>- Designing mechanisms for facilitating evaluation.</td>
<td></td>
<td>- IT (APP design)</td>
</tr>
<tr>
<td><strong>Purchase Decision</strong></td>
<td>- Security, reliability and convenience of transactions.</td>
<td>- IT management</td>
</tr>
<tr>
<td>- Combining with online services to bring consumers from online to offline (O2O).</td>
<td></td>
<td>- Accounting</td>
</tr>
<tr>
<td>- Integrated with other enterprise system to make the data consistent and accurate. The integration can make the overall purchase process be optimized.</td>
<td></td>
<td>- Sales</td>
</tr>
<tr>
<td><strong>Post-purchase Behavior</strong></td>
<td>- Providing value added and interactive services to customers.</td>
<td>- Customer service</td>
</tr>
<tr>
<td>- Integrated with other customer service (such as loyalty program and social marketing)</td>
<td></td>
<td>- Strategy planning</td>
</tr>
<tr>
<td>- Customer behavior analysis and relationship management</td>
<td></td>
<td>- Big data</td>
</tr>
</tbody>
</table>

**CONCLUSION**

Recently Internet has been shaping people live in a tighter way by extending the Internet to objects or locations in the real world. In light with this, this study uses a framework of a consumer buying decision process to discover and illuminate key issues that practitioners may face as they approach business changes resulting from the diffusion of AIDC technologies. We have considered these issues along the dimensions of value creation, value orientation, functionality, key factor and challenges, key activities within organization, and managerial issues concerned. In conducting this analysis, we also noted some challenges that firms need to face across the buying process, particularly in the case of the required integration within and between organizations. AIDC technologies can automatically and easily collect transaction and customer data. Moreover, despite the wide availability of AIDC technologies, many skeptics have also pointed out how pointless and boring some tagging system such as QR code marketing have turned into. According to the survey, we found that only when the information gathered by identified objects is used, analyzed, and distributed into wide business activities in term of marketing, customer service and firm level strategy planning, the effectiveness and value of object hyperlinking services can be realized at its maximum. As one can imagine, an advance and effective application of object hyperlinking must necessarily be the synergetic results conducted in different business activities, including marketing, information management, customer service, logistics, and strategy planning. The integration across different consumer buying decision process is also important. The more applications of object hyperlinking in different buying decisions, the more benefits will be created for customers.

The survey results of 76 projects also found that many SME (small and middle enterprise) discontinuous their projects after 2-3 years later from the project initiated. It is because no immediate performance was produced from object hyperlinking applications and the return on investment (ROI) was difficult to evaluate. Few reliable ROI analyses of AIDC applications are available [12]. Just like Ferguson puts it, “the business case spending on RFID is a raw guess,” making return on investment (ROI) difficult to evaluate [6], [10]. This is truth for all AIDC technologies. Posed with uncertainty regarding whether AIDC technologies are in fact ready to support their needs, managers may put off adoption of AIDC technologies. Firms limited with manpower and financial resource may stop to adopt object hyperlinking service.
REFERENCES

DESIGN FACTORS OF MUSEUM NAVIGATION SYSTEM ON THE MOBILE SMART-PHONE APP

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ABSTRACT
Due to the integration of cultural tourism and digital technology, tourists are no longer passively content with pre-arranged tours. As a system developer, one should concern about how to embed a mobile navigation system into smart phones to increase the learning experience of tourists. This study uses the visitors of National Palace Museum as research subjects and categorizes 7 design guidelines with 38 influence factors base on review of literature and analysis of personal digital navigation systems in various domestic and foreign museums. After the use of AHP (analytic hierarchy process), this study identifies that improving information quality in the mobile navigation systems and enhancing the convenience of communication between user and the system not only improve the tourist's willingness to use the system but also enhance the user's level of knowledge. Furthermore, when users realize the potential of enhancing knowledge by the system, they will increase the system use.

Keywords: Museum navigation, design factors, smart phone, mobile navigation system, analytic hierarchy process.
DEVELOPING AN OPTIMAL MULTIVARIATE FORECASTS MODEL FOR
SUPPLY CHAIN INVENTORY MANAGEMENT—A CASE STUDY OF A
TAIWANESE ELECTRONIC COMPONENTS DISTRIBUTOR

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ABSTRACT
By reducing the volume of inventory and the ratio of obsoleted stock, enterprises can not only lower their cost and risk in a great amount, but also increase their flexibility of capital management. Thus, inventory issues are always taken seriously in enterprises’ supply chains. In the last decades, both industries and academia have come up with multiple solutions to avoid the damage caused by market volatility and to diminish the bullwhip effect. Examples include Toyota Production System (TPS), vendor managed inventory (VMI), collaborative planning, forecasting, and replenishment (CPFR) and so forth. However, little research has addressed the issue regarding with the optimal order amount given the forecast of customers’ demand. The issue is important because order amount is directly related with stock shortage and the inventory cost. To answer the question, this research aims to develop an optimal multivariate forecast model to determine how much and when we should order so that the inventory cost and the rate of stock shortage can be minimized. We will develop a decision support system (DSS) to implement our model.

The bullwhip effect shows that if a retailer periodically updates the mean and variance of demand based on observed customer’s demand data, the variance of the orders placed by the retailer will be greater than the variance of demand [4]. Lee et al. (2007) [6] suggested information sharing and coordinate orders among the supply chain are solutions to alleviate the adversity of supply chain uncertainty that mentioned above, including the whiplash effect and dead stock risk. This research will develop an optimal multivariate forecasts to solve the problem [3] [4]. Multivariate forecasts use more than one equations if the variables, such as lead time, backlog and stock, are jointly dependent. We will compare our proposed model with exponential-smoothing forecasting model and a moving-average model to see which model is more applicable. We will also compare a correlated demand with a demand with linear trend to determine which one will be used in our optimal forecasting model.

Decision Support System (DSS) can integrate analytical models responsive to the view point of a business process such as demand management [5]. Thus, we will implement our analytical model using DSS. Even though several researchers have already developed DSS regarding with inventory management, like Achabal’s research in 2000 [1] and Cakir’s research in 2008 [2], few of them emphasize environmental dynamics such as demand uncertainty, significant seasonality, short product life cycle or high competitive intensity. Our model will address this issue by developing a multivariate forecasting model which considers multiple uncertainty factors. We will collect data from an electronic components distributor (ABC company).

The data collection will be started at the beginning of 2016 and completed before March 2016. The data will enable us to test and refine our analytical model and make the DSS more feasible. We expect the DSS can support the ABC company to decide how much they should order and when is the best time for ordering in terms of reducing inventory. Therefore, the contribution of this research can be two-folded: first, to design a DSS that can actually help the case company to manage their orders more effectively, and, second, to find out variables that are related to inventory optimization in a dynamic environment and to develop an analytical model that is more general to be applied in other industries.

Keywords: Decision Support System (DSS), Supply Chain, Inventory, Multivariate Forecasts, Electronic Components Distributor

REFERENCES
DO TOP-PERFORMING COMPANIES USE BUSINESS ANALYTICS DIFFERENTLY AND WHY?

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ABSTRACT

It is suggested that companies that use business analytics perform better than those that do not in making strategic decisions and creating business value. However, little academic research based on theories exists to examine the extent to which companies differ in using business analytics and why this difference may contribute to company performance difference. To reduce this knowledge gap, this paper investigates the extent to which top and bottom performing companies differ in using business analytics by means of analysis of variance based on 232 responses collected from UK manufacturers, and seeks to explain how this use difference may be linked to performance difference drawing on the information processing view and path dependence theory. The research findings indicate that top-performing companies are three times more likely than bottom-performing companies to use business analytics and develop a data-driven environment simultaneously; and that the company differences regarding the use of business analytics and the resultant performance may be due to path dependence and how relevant organisational factors are designed. The study contributes to business analytics literature by providing empirical evidences and offering a theoretical-based understanding of business analytics, providing a foundation for future research. This study also has important managerial implications by demonstrating how business analytics can be used to improve performance.

Keywords: Business analytics, data-driven environment, information processing view, organisational performance, ANOVA.

INTRODUCTION

Business analytics (BA) refers to “the extensive use of data, statistical and quantitative analysis, explanatory and predictive models, and fact-based management to drive decisions and actions” [1, p.7]. Facing the challenges of big data, increasing competition, and technological advancement, companies are increasingly using BA to gain valuable data-driven insights thereby to improve organisational performance [2][3]. For instance,[21] suggests that companies that use BA perform better than those that do not in creating competitive advantages and it is important for companies to step up the use of BA to make better business decisions thereby to create strategic value. While BA’s importance has been recognised and BA is emerging as an important research area [18][5][], little is known about the mechanisms through which BA can be used to create business value [3]. Thus, it remains unclear how BA affects organisational performance and how it is affected by other organisational factors [24]. This paper attempted to examine the following research questions that are key to developing a theory-based understanding of BA: To what extent do top and bottom performing companies differ in using BA and why?

In order to fill this knowledge gap, this paper drew on the information processing view of organisational design [9, 10] and path dependence theory [10][23] to conceptualise the association between BA and organisational performance and the extent to which top and bottom performing companies can be differentiated regarding their use of BA. This paper’s conceptualisation was empirically tested using analysis of variance (ANOVA) based on 232 responses collected from UK manufacturing industry. It focused on the UK manufacturing sector since it is currently the 11th largest manufacturing nation in the world and accounts for about 8.5% of the UK workforce, 54% of the exports, and 12% of the country’s national output. Whilst this industry is relatively efficient and in relative decline [27], it faces considerable challenge of generating significant productivity improvement. There is also indication that this industry has been slow in incorporating BA [12] and only a small fraction of them are currently using BA in the areas of operations and across their supply chains [28]. Hence, understanding how to use BA to improve organisational performance is of enormous use to practitioners in the manufacturing sector and academics alike.

This paper’s findings indicated that top-performing companies are more likely than bottom-performing companies to use BA and develop a data-driven environment; and that the company differences regarding the use of BA and the resultant performance may be due to path dependence and how relevant organisational factors are designed. The research findings should be useful to researchers who wish to expand knowledge in this research domain and have important managerial implications for manufacturing companies wanting to use BA. The structure of the paper is as follows. The next section presents the conceptualisation and hypotheses. The subsequent section describes the data collection processes and reports on the empirical results. The final section discusses the results and implications.

LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

BA consists of the processes and techniques of data analysis for the generation of knowledge and intelligence to support organisational decision-making [16], which can be classified into three main categories: descriptive, predictive, and prescriptive [11]. Descriptive analytics is mainly used to describe the context of and trending information on past or current events, answering what has happened and what is happening. Predictive analytics is used to predict the future happenings and the reasoning as to why, answering what could happen. In addition, prescriptive analytics can be used to prescribe one or more courses of action and shows the likely outcome of each decision, providing answers to what should we do. There is general indication that most organisations...
use descriptive analytics to various degrees while much fewer use prediction and prescription analytics [5][22]. Regardless, BA is seen to offer the possibilities for companies to be more effective at making strategic decisions and creating competitive advantages [4]. Four consecutive large scale questionnaire surveys have consistently showed that companies that use BA perform better than those that do not [19][20][21][22]. The findings from the latest survey suggest that 87% of respondents strongly or somewhat agree that it is important for their organisations to step up the use of BA to make better business decisions [4]. However, these surveys are “predominantly practice driven” [14] and rarely based on testable models and relevant theories. As a result, little is known about the mechanisms through which BA can be used to improve organisational performance; in particular, it remains unclear how companies such as those in manufacturing industry are using and affected by BA.

Understanding BA from the Information Processing View

In order to understand to what extent and how a company might use various types of BA to improve its performance, the information processing view of organisational design [13][10] provides a useful theoretical underpinning. This view advocates that an organisation needs to design for example its structure [10] and business processes [26] so that it can match its information processing capabilities with its information processing requirements to inform its decision-making, manage uncertainty, and ultimately improve its performance. The information processing view has been used by a few empirical studies in the context of supply chain management to understand the interactive effect of information processing needs and information processing capabilities on performance [26][2][25]; however, few BA studies underpinned by this view apart from [3].

Nevertheless, a number of practice-oriented BA studies have suggested ideas that are seen to be consistent with the information processing view. For instance, [15] suggests that while BA and big data provide significant opportunities to reshape businesses, the adoption of BA has been slow since processing big data using BA requires not only developing new and innovative forms of information processing capabilities but also considering issues such as centralisation versus decentralisation. Likewise, it is suggested companies need to develop an “analytically driven strategy” [4], relevant business processes [2] and organisational structure [1].

Drawing on the information processing view and existing BA studies, a company can be thus expected to be more likely to use BA to gain data-driven insights to improve its decision-making and performance when it has developed a data-driven environment reflected by developing explicit strategy and policy to guide analytic activities and designing its structure and processes to enable analytics activities [3]. If this assumption is reasonable, then companies that use BA supported by a data-driven environment should be expected to be top-performing companies in terms of their financial outcomes. On the contrary, without developing such a data-driven environment, “a company will not know on which data to focus, how to allocate analytic resources, or what it is trying to accomplish in a data-to-knowledge initiative” [2, p. 122]; consequently, companies that have not developed a data-driven environment are more than likely to be the bottom-performing companies. Thus, it is conceivable to conjecture that a company will be able to significantly improve its performance using BA when it has created a data-driven environment by embedding BA into relevant organisational strategy, structure and processes.

Hypothesis 1. Top-performing companies are more likely to have developed a data-driven environment.
Hypothesis 1a. Top-performing companies are more likely to depend on data-based insights to support decision making
Hypothesis 1b. Top-performing companies are more likely to develop a data-driven strategy to guide BA activities.
Hypothesis 1c. Top-performing companies are more likely to develop relevant organisational structure to enable BA.
Hypothesis 1d. Top-performing companies are more likely to develop relevant organisational process to embed BA.

While the above hypotheses clearly recognise the association between BA and a data-driven environment, the cause-effect relationship between them is beyond the scope of this research.

Understanding BA from Path Dependence

Further, we also posit that top-performing companies’ using BA could be path dependent, referring to a stochastic process whose distribution of outcomes evolves as a function of its own history [10]. In other words, a company’s current use of BA can be shaped by the path it has travelled: its previous investments in analytics and its relevant history matter and will constrain its future behaviour. Path dependence may help us to understand how a series of early events can initiate a self-reinforcing process such as complementarity and learning effect [29], thereby influence strategic choices made by companies [16].

For instance, [23] demonstrates that firms has been actively developing IT capabilities are more likely to repeat this than firms lacking such experience. This follows because organisational learning in a firm tends to be local and often draw on its previous activities [30]. As a result, the self-reinforcing nature of path dependence is expected to bring about a preferred action pattern, which then gets deeply embedded in organisational practice and replicated [31]. Furthermore, an organization’s core technology tends to be path dependent as changing it requires simultaneous adjustments in other organisational features [17]. However, path dependency can also be understood as “a rigidified, potentially inefficient action pattern built up by the unintended consequences of former decisions and positive feedback processes” [31, p. 696]. Thus, it is important to understand that the dynamics of self-reinforcing mechanisms may eventually lead to an irreversible state of total inflexibility [9] and being strategically inefficient [31], thus constrain subsequent choices [17] rather than a virtuous circle.

The Fifteenth International Conference on Electronic Business, Hong Kong, December 6-10, 2015
Based on the path dependency theory, it is expected that the use of BA and a data-driven environment in an organisation is closely related and thus path dependent. BA is intertwined with big data [16] and builds on sophisticated information technologies such as the scale-out architecture, Hadoop, cloud services, new “agile” analytical methods, and machine-learning techniques. BA also requires a data-driven environment if it is to be used effectively [1][2][4]. As a result, BA can be seen as a core technology since it is entangled with other key organisational features. Once an organisation has developed a data-driven environment reflected by for instance relevant strategy, structure and process to embed BA activities, this is likely to be path dependent. This practice is also likely to be repeated by self-reinforcing process such as complementarity, coordination, learning and adaptive effects [29]. BA and a data-driven environment are complementary: BA will help provide data-driven insight while a data-driven environment ensures that this insight to be used to support decision-making with maximum effect, which in turn will reinforce the usefulness of BA and a data-driven environment. Enabling BA with a data-driven environment then becomes more attractive and is likely to be repeated in the future, leading to coordination effect. The more an organisation uses BA enabled by a data-driven environment, the more effective it becomes due to accumulated relevant knowledge, experience and skills through using BA, which results in learning effect. When data-driven decision-making is proved to be effective, organisational members will be willing to adopt this practice, thereby leading to adaptive effect. Because of these self-reinforcing processes, BA enabled by a data-driven environment is highly likely to be path dependent.

Therefore, companies with a data-driven environment tend to embark on a virtuous circle. In contrast, companies without a data-driven environment are arguably less likely to use BA or use it as effectively to improve their organisational performance as they lack the self-reinforcing processes. Consequently, it is perceivable that companies with a data-driven environment are more likely to use BA. Again, the above hypotheses focus on the association between data-driven environment and BA rather than the cause-effect relationship between them, which will be addressed in a different research. Thus, we propose:

Hypothesis 2. Companies with a data-driven environment are more likely to use BA.
Hypothesis 2a. Companies with a data-driven environment are more likely to use descriptive analytics.
Hypothesis 2b. Companies with a data-driven environment are more likely to use predictive analytics.
Hypothesis 2c. Companies with a data-driven environment are more likely to use prescriptive analytics.

RESEARCH METHODOLOGY

To test the hypotheses empirically, a questionnaire survey using a five-point Likert scale was conducted to collect responses from medium-sized (number of employees between 50 and 250) and large UK manufacturing companies (more than 250 employees) as they are expected to have the “capabilities” and “substantial resources” to employ various types of BA for business improvement [15]. The survey was delivered to the CEO of each company through Qualtrics while the email addresses were identified from the FAME database. Three rounds, four weeks apart, of emails including a cover letter with a questionnaire were sent. Each intended respondent was offered a summary of the results. While a total of 21,149 emails were sent, it was not known how many e-mails were opened. Of all sent emails, 782 surveys were opened and 232 usable responses were received. The response rate was not calculated as the literature provides no agreed methods for doing this with mass email surveys such as ours.

The reported positions of the respondents suggested that 26% of the respondents were in a senior managerial position and the rest of them were directors of various departments such as finance or accounting (13%), operations (13%), marketing and sales (11%), and IT (8%). Of all respondents, 49% had been with their firms for more than 10 years, whilst 86% had been in the industry for more than 10 years. Based on their managerial positions and experiences, the respondents were highly likely to participate in decision-making processes related to the topic of the survey [25].

Based on BA research [3][19][16][17], we measured a company’s data-driven environment in terms of its depending on data-based insights to support decision making, having a well-defined organisational structure to enable analytical activities, analytical activities being integrated into business processes and aligned with organisational strategies. Based on [11], we measured descriptive analytics in terms of the use of statistical analysis, business reporting, query and analysis, spreadsheet, and web analytics; predictive analytics with regard to the use of data and text mining, forecasting, and predictive modelling; and prescriptive analytics with reference to the use of optimisation, simulation and scenario development, model management, and interactive data visualisation. Finally, we measured organisational performance with regard to perceived profitability comparing to key competitors. The descriptive statistics of the research variables are presented in Table I.

MAIN FINDINGS

ANOVA was used to test the hypotheses. Participants were divided into three groups according to their perceived profitability comparing to key competitors scored from 1 to 5 on a five-point Likert scale: Group 1 including top-performing companies (n = 52) with a score of 4 or 5 (M = 4.173, SD = 0.378), Group 2 including medium-performing companies (n = 115) with a score of 3 (M = 3.0, SD = 0.000), and Group 3 including bottom-performing companies (n = 65) with a score of 1 or 2 (M = 1.877, SD = 0.328). A test of homogeneity of variances was conducted. All variables were homogenous except for forecasting, business reporting and spreadsheet. However, these three exceptions’ robust tests (Welch and Brown-Forsythe) were significant; thus their homogeneity tests were considered acceptable. A one-way between-group ANOVA was conducted to evaluate the equality of
variable means across the groups and thus assess the distinctiveness of each group with reference to data-driven environment, descriptive analytics, predictive analytics and prescriptive analytics. The ANOVA results are summarised in Table II. The F-tests confirmed that, across the three groups, except for all prescriptive variables and two predictive analytics variables, the rest of these means differed statistically significantly. Of these differed, Tukey's HSD tests were conducted to determine which groups in the sample differed. In terms of forecasting, business reporting, spreadsheet, query and analysis, and depending on data-based insights to support decision making, all groups were distinguishable. With regards to statistical analysis, organisational structure developed to enable analytical activities, processes well-developed to embed analytical activities, and organisational strategies developed to guide analytical activities, Group 1 and 3 differed significantly while Group 2 was not.

### TABLE I. DESCRIPTIVE STATISTICS (N = 232)

<table>
<thead>
<tr>
<th>Variables (measured by five-point scales)</th>
<th>Mean</th>
<th>S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data-driven environment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depending on data-based insights to support decision making</td>
<td>2.987</td>
<td>1.186</td>
</tr>
<tr>
<td>Organisational structure developed to enable analytical activities</td>
<td>2.879</td>
<td>1.058</td>
</tr>
<tr>
<td>Processes well-developed to embed analytical activities</td>
<td>3.000</td>
<td>1.089</td>
</tr>
<tr>
<td>Organisational strategies developed to guide analytical activities</td>
<td>2.914</td>
<td>1.082</td>
</tr>
<tr>
<td>Descriptive analytics</td>
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<td></td>
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<td>Statistical analysis</td>
<td>2.914</td>
<td>1.387</td>
</tr>
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<td>Business reporting</td>
<td>2.909</td>
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<td>Query and analysis</td>
<td>2.815</td>
<td>1.404</td>
</tr>
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<td>Spreadsheet</td>
<td>2.810</td>
<td>1.821</td>
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<td>Web analytics</td>
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<tr>
<td>Predictive analytics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data and text mining</td>
<td>2.927</td>
<td>1.319</td>
</tr>
<tr>
<td>Forecasting</td>
<td>2.823</td>
<td>1.601</td>
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<tr>
<td>Predictive modelling</td>
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<td>Prescriptive analytics</td>
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<tr>
<td>Optimisation</td>
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<td>Simulation and scenario development</td>
<td>2.987</td>
<td>1.236</td>
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<tr>
<td>Model management</td>
<td>2.819</td>
<td>1.381</td>
</tr>
<tr>
<td>Interactive data visualisation</td>
<td>2.996</td>
<td>1.416</td>
</tr>
<tr>
<td>Perceived profitability comparing to key competitors</td>
<td>2.948</td>
<td>0.851</td>
</tr>
</tbody>
</table>

### TABLE II. ANOVA RESULTS

For the analysis, the odds ratio of high score in Group 1 to high scores in Group 3 is calculated. The odds ratio is less than 1 if Group 1 scored lower than Group 3.

### TABLE III. THE ODDS RATIO OF HIGH SCORE IN GROUP 1 TO HIGH SCORES IN GROUP 3

<table>
<thead>
<tr>
<th>Variables</th>
<th>Group 1 (n=52)</th>
<th>Group 2 (n=115)</th>
<th>Group 3 (n=65)</th>
<th>F (ANOVA)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>S.D.</td>
<td>Mean</td>
<td>S.D.</td>
</tr>
<tr>
<td>Data-driven environment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depending on data-based insights to support decision making</td>
<td>3.731</td>
<td>0.992</td>
<td>2.948</td>
<td>1.191</td>
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<tr>
<td>Organisational structure developed to enable analytical activities</td>
<td>3.250</td>
<td>1.186</td>
<td>2.870</td>
<td>0.996</td>
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<tr>
<td>Processes well-developed to embed analytical activities</td>
<td>3.423</td>
<td>1.091</td>
<td>3.043</td>
<td>1.021</td>
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<tr>
<td>Organisational strategies developed to guide analytical activities</td>
<td>3.308</td>
<td>1.058</td>
<td>2.930</td>
<td>1.057</td>
</tr>
<tr>
<td>Descriptive analytics</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Statistical analysis</td>
<td>3.385</td>
<td>1.360</td>
<td>2.922</td>
<td>1.396</td>
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<tr>
<td>Business reporting</td>
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<td>1.428</td>
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<td>1.754</td>
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<tr>
<td>Query and analysis</td>
<td>3.673</td>
<td>1.279</td>
<td>2.826</td>
<td>1.372</td>
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<tr>
<td>Spreadsheet</td>
<td>3.981</td>
<td>1.540</td>
<td>2.791</td>
<td>1.819</td>
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<tr>
<td>Web analytics</td>
<td>3.077</td>
<td>1.311</td>
<td>2.765</td>
<td>1.327</td>
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<tr>
<td>Predictive analytics</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data and text mining</td>
<td>3.000</td>
<td>1.314</td>
<td>2.852</td>
<td>1.258</td>
</tr>
<tr>
<td>Forecasting</td>
<td>3.615</td>
<td>1.484</td>
<td>2.877</td>
<td>1.594</td>
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<tr>
<td>Predictive modelling</td>
<td>2.827</td>
<td>1.339</td>
<td>2.878</td>
<td>1.319</td>
</tr>
<tr>
<td>Prescriptive analytics</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Optimisation</td>
<td>2.942</td>
<td>1.259</td>
<td>2.896</td>
<td>1.165</td>
</tr>
<tr>
<td>Simulation and scenario development</td>
<td>3.077</td>
<td>1.384</td>
<td>2.896</td>
<td>1.195</td>
</tr>
<tr>
<td>Model management</td>
<td>2.673</td>
<td>1.382</td>
<td>2.835</td>
<td>1.420</td>
</tr>
<tr>
<td>Interactive data visualisation</td>
<td>3.096</td>
<td>1.347</td>
<td>2.861</td>
<td>1.456</td>
</tr>
</tbody>
</table>

***not significant, "***"p<0.001
As Groups 1 and 3 were mostly distinguishable with regards to those variables with a significant F-test, an additional question was to what extent they differed. To answer this question, the odds ratio of high scores (4 and 5) in Group 1 to high scores (4 and 5) in Group 3 was calculated in terms of each variable that had a significant F-test. The odds ratios summarised in Table III suggest that top-performing companies are three times more likely than bottom-performing companies to develop a data-driven environment, three to twelve times likely to use descriptive analytics, and almost six times likely to use forecasting.

Thus, hypothesis 1 is supported, which suggests that top-performing companies are more likely than bottom-performing companies to depend on data-based insights to support decision making, develop a data-driven strategy to guide BA activities, develop relevant organisational structure and process to enable BA and to embed BA.

Similarly, ANOVA and an analysis of the odds ratio of high scores were conducted to test Hypothesis 2. Again, participants were divided into three groups according to the extent to which the responding company depends on data-based insights to support decision making, develops organisational structure to enable analytical activities, develops processes to embed analytical activities, or develops organisational strategies to guide analytical activities. The analysis confirmed that Hypothesis 2 is supported, suggesting that companies with a data-driven environment are more likely to use descriptive analytics, predictive analytics, and prescriptive analytics; and they tend to be top-performing companies.

**DISCUSSIONS AND CONCLUSIONS**

The results lead us to generally accept the research hypotheses that top-performing companies in the UK manufacturing industry are significantly different from bottom-performing companies with reference to developing a data-driven environment and using BA. Consequently, top-performing companies are more likely than bottom-performers to fully realise the benefits from their investment in BA. However, there are particularities to be further discussed.

The research findings indicate that top-performing manufacturing companies display important characteristics. First, they use BA more coherently by creating a data-driven environment to support and enable the use of BA. Specifically, an analytical strategy is developed to guide the use of BA; relevant organisational structure and process are designed to embed BA, and data-driven insights are used to inform decision-making. Second, top-performing companies are three times more than bottom-performers to use descriptive analytics to describe what has happened and what is happening and forecasting to predict what could happen. As a result, top-performing companies are more likely to have reliable and accurate information to make successful decisions, to generate viable organisational strategies, and thereby to significantly improve their performance. This provides empirical evidence in support of the ideas that the effective use of BA requires the development of relevant analytical strategy, organisational structure and processes [1][2][4]. Our research findings also contribute to the information processing view by demonstrating that organisational design is essential for organisations to match their information requirements and processing to inform decision-making and improve organisational performance.

Additionally, this research contributes to prior research on path dependence [10][23] by providing empirical support. Our findings imply that the use of BA in a manufacturing company may be path dependent, affected by complementarity, coordination, learning and adaptive effects [29]. Thus one of the key reasons why top-performing manufacturing companies are three times more likely to use BA may perhaps be related to the path they have travelled. While prior research [9][31][1] suggests that self-reinforcing process could eventually lead to an irreversible state of total inflexibility and being strategically inefficient, the specific case of the use of BA does not seem to be possible to bring about a deterministic character that render alternative courses of action no longer feasible. In contrast, the use of BAwould help companies to be able to gain data-driven insights, thereby to systematically evaluate alternative courses of action and make better decisions.

However, an awareness of path dependence can certainly impact the choices that bottom-performing companies can make regarding the use of BA. Such an understanding can enable them to reflect practices in terms of path dependence and potentially opens a window for path-breaking [17] or creation [30] activities that allow them to use BA effectively. The findings from this study suggest unless they take steps to create a path to enable them to start to use BA, to develop their learning capabilities and analytical capabilities, they are unlikely to be able to realise the potential benefits offered by BA.

Two key managerial implications can be derived from this study. First, manufacturing companies are likely to be more effective at using BA to inform decision-making and improve their performance by developing a data-driven environment that coherently enables analytics activities. Second, in order for manufacturing companies to realise the benefits from BA, they need to take steps to use, and develop their learning and analytical capabilities to be able to use BA.
Our research is based on survey from UK manufacturing companies and may not be applicable to other sectors and future research can extend this to other industries. Despite this limitation, however, we believe our study offers two other opportunities for future research. First, both predictive and prescriptive analytics could be further investigated to understand how they are used and what their impact on organisations is. Second, the cause-effect relationship between BA and a data-driven environment could also provide an interesting future research area.

REFERENCES


DOES A CUSTOMER’S OWN REVIEW BEHAVIOR HAVE AN IMPACT ON ITS PURCHASE BEHAVIOR? ANALYZING THE IMPACT OF REVIEW PLATFORM ON GROUP-BUYING PLATFORM--A STUDY BASED ON DIANPING.COM

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ABSTRACT
With the development of Web 2.0, traditional customers have increasingly transferred to online purchase and created a large volume of User Generated Content (UGC) on the Internet. The changes brought traditional customer relationship management a great impact and forced companies to adapt, change and evolve. The previous researches have studied the influence of crowds’ feedback on customer’s purchase behavior, but little researches explore the impact of customer’s own review behavior on its purchase behavior. In this paper, our study seeks insights into analyzing the impact of customer’s own review behavior on its purchase behavior and discovering how this effect could be fully utilized to predict customer’s next stage churn. Based on data from Dianping.com, a famous comprehensive website which contains review and purchase platforms, we build the Logit regression model, considering customer’s own review and purchase behavior and finding the impact of user’s own review behavior on purchase behavior. Finally, we also use ten-fold cross-validation to prove the stability of our model.

Keywords: User generated content, Logit regression model, Customer churn model, Customer review, Ten-fold cross-validation

INTRODUCTION
Does a customer’s own review have an impact on its purchase behavior? With the continuous development of Web 2.0, more and more customers will post a comment to share their experience after they make some purchase online. New e-commerce sites with comments has arisen at home and abroad, such as Dianping.com and Douban.com in China, as well as Yelp.com in America. There are a mass of customer reviews on these website, which have offered information reference for both online and offline customers. The massive reviews has met the purchase requirement of online customers and attracted the offline customers. Data show that there are more than 23 million comments on Dianping.com till the last quarter of 2012. A number of researchers have discovered that plenty of customer reviews will make an effect on other customers’ purchase behavior. Chevalier and Mayzline (2006) find that emotion in comments have an effect in the customer’s decision [2]. Research shows that more online reviews and greater intensity will lead to greater impact on customer purchase intention [9]. Research also shows that review valence, other user’s aggregated helpfulness rating of the review, and another user’s verbal agreement or disagreement with the review will affect customer decision [3]. All these research study the review’s effect on other user’s purchase behavior. However, there is little literature related to whether review will influence the customer’s own purchase behavior.

Customer review behavior is a sign of customer participation. From the behavior perspective of customer participation, it is identified as a customer behavior. Kellogg (1997) believe that customer participation include preparing for the purchase, contacting with the firm in the purchasing process, and giving some suggestion to the firm after the purchase [4]. As can be seen, customer review behavior is a process of giving suggestions to the firm after making some purchase, it is also a process of preparing for the customer’s next purchase. From the result perspective of customer participation, customer participation is a process of value creation. Lloyd (2003) think that the process of customer participation contribute resources and capability, which will affect the quality of service received by the customer itself [5]. As a portion of customer participation process, customer review will affect the quality of service received by itself, and even affect its subsequent purchase behavior.

Above all, customer’s own review behavior will not only affect other customer’s purchase behavior, but also affect its own subsequent purchase behavior. In this paper, we will mainly consider the effect of customer’s own review on its purchase behavior. With customer’s churn behavior as the dependent variable, we will study the effect of customer review behavior on the next stage of churn behavior. Furthermore, we have built the model to predict the customer churn behavior more accurately.

We organize the rest of the article as follows: Firstly, the literature review is presented. Then, the research design and model building are described. Thirdly, the methodology is presented, including the data description, variables explanation, and result analysis. Finally, this research is concluded.
LITERATURE REVIEW

Factors Affecting Customer Churn Behavior

Currently, researchers have studied the factors affecting customer churn behaviors, mainly divided into two aspects: customer own factors and previous purchase behaviors. As for customer own factors, researchers have taken the effect of demographics on customer churn behaviors into consideration and bring it into the prediction models. For example, Zhu and Zhang (2010) introduced five demographic characteristics about customer gender, age, marital status, educational attainment and annual income [10]. Wang (2013) further treated customer category and profession as the key attributes in his model [7]. Cao, Xu and Shen (2012) found the significant effect on customer churn behaviors related to their gender and age, using so-called multidimensional commercial bank customer churn prediction model based on RFM model and demographic variable [1]. Ren and Zhang (2012) also considered customer age, gender and annual income in their prediction model [6].

Regarding the customer previous purchase behaviors, researchers have thought about the influence of indicators involved in RFM model and other purchase behaviors in prediction models. For instance, Wang (2013) studied three indicators of RFM models including total transaction amount, total transaction frequency and the time of last transaction as well as the basic customer reward points, phased transaction amount and quantity, etc. [7]. Cao, Xu and Shen (2012) used the time interval of last transaction and the total transaction amount and frequency to predict customer churn behaviors [1]. Ren and Zhang (2012) adopted the transaction amount, repeat transaction frequency, the number of transactions during the day and night in their model [6]. Zhu and Zhang (2010) also imported repeat transaction frequency, the time of last transaction, transaction amount, the number of transactions during the day, at night and midnight [10].

To sum up, we give an overall review about the main factors affecting customer churn behaviors by various researchers in Table 1:

<table>
<thead>
<tr>
<th>dimensions</th>
<th>factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>customer own factors</td>
<td>gender, profession, age, marital status, income, educational attainment</td>
</tr>
<tr>
<td>customer previous purchase behaviors</td>
<td>transaction amount, the number of transactions during the day, basic customer reward points</td>
</tr>
<tr>
<td></td>
<td>repeat transaction frequency, the number of transactions at night, the number of transactions during worktime</td>
</tr>
<tr>
<td></td>
<td>the total transaction frequency, the number of transactions at midnight, the time of last transaction</td>
</tr>
<tr>
<td></td>
<td>the time of first transaction</td>
</tr>
</tbody>
</table>

As shown in table 1, it is easy to find that researchers just consider the effect of customer’s own factors and previous purchase behaviors on customer churn behaviors at the present stage. With the development of Web 2.0 era, more and more customers tend to publish their opinions and views of product on purchase platforms. Will this spontaneous review behavior affect the customer’s own churn behaviors? As far as we know, no researchers have done similar works, and thus, we further consider the customer’s own review behavior as well as customer’s own factors and purchase behaviors in our prediction model, focusing on the effect of customer’s own review behavior and the accuracy of the prediction.

Method for the Prediction of Customer Churn Behaviors

Researchers have recently adopted several methods to predict customer churn behaviors, such as Logit regression model [8], neural network [6] [7], SMC [10] and LSSVM [6]. Detailed comparison can be found in Table 2:
Table 2. comparisons among different prediction methods

<table>
<thead>
<tr>
<th>model name</th>
<th>description</th>
<th>pros</th>
<th>cons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Logit regression model</td>
<td>econometric model</td>
<td>The introduction of multiple independent variables and their influence on dependent variables and significance level, high dynamic nature.</td>
<td>high complexity, hard to determine parameters</td>
</tr>
<tr>
<td>neural network</td>
<td>BP neural network (BPNN) as the most widely used feedforward type neural network, is composed of input, hidden and output layer which are all consist of nerve cell with different transfer functions.</td>
<td>Any complex nonlinear mapping functions can be implemented successful; self-learning ability; Multivariable system, i.e. the number of input and output variable is arbitrary</td>
<td>too long learning time; Number of hidden layer neurons is uncertain, needing cut-and-trial</td>
</tr>
<tr>
<td>SMC</td>
<td>calculate the activity, identifying those customers who are still active</td>
<td>directly calculate the activity of individual customers</td>
<td>use only a few key variable information, ignore a lot of explanation variable, prediction performance is not ideal</td>
</tr>
<tr>
<td>LSSVM</td>
<td>a modified SVM with the introduction of least square linear system, using equality constraints instead of inequality constraints, the solving process varies from the quadratic programming method to solve a set of equations, relatively faster.</td>
<td>very flexible nonlinear modeling capabilities, well to get the nonlinear mapping relationship between input and output variables.</td>
<td>high complexity</td>
</tr>
</tbody>
</table>

As described above, we adopt the Logit regression model to study the effect of customer’s own review behavior on their churn behaviors due to the pros mentioned in Table 2, building a comprehensive model with customer’s own factors, customer purchase behavior and customer’s own review behavior in consideration.

**RESEARCH DESIGN AND MODEL BUILDING**

**Conceptual Framework**
Consumer’s current behavior can indirectly reflect the possibility to purchase in the next phase, which can be used as an important basis to estimate the customer churn behaviors. In era of Web 2.0, more and more customers tend to publish their opinions and views of product after purchase, which can indirectly reflect the use viscosity of customers with respect to the product, enterprise or website and make the enterprise consider the factors of customer churn behaviors roundly with the aid of a modified prediction model. Herein, we further introduce the customer’s current review behavior on the basis of customer’s own factors and customer purchase behavior, focusing on the effect of customer’s own review behavior on customer churn behaviors and the improvement of prediction accuracy. Our model conceptual framework can be seen intuitively in Fig. 1.
Model Building

Basic model

Customer churn model is used to analyze and predict the influence factors of their churn behaviors. The dependent variable of this model is the customer churn behaviors in the next stage while independent variables are customer’s own factors, customer purchase and current review behaviors. As a binary variable (churn: 1 and unchurn: 0), customer churn behaviors can be analyzed by a Logit regression model using a basic formula:

\[ \text{Churn}_{it} = \frac{e^{\vec{\beta}x_{it} + \vec{\gamma}y_{it} + \vec{\delta}z_{it} + \vec{\varepsilon}_{it}}}{1 + e^{\vec{\beta}x_{it} + \vec{\gamma}y_{it} + \vec{\delta}z_{it} + \vec{\varepsilon}_{it}}} \]  

(1)

\[ L_{it} = \vec{\beta}_i \text{User}_{it} + \gamma \text{Purchase}_{it-1} + \delta \text{Comment}_{it-1} + \varepsilon_{it-1} \]  

(2)

Where, Churn\textsubscript{it} represents the possibility of customer churn behaviors in the next stage, is also a binary variable; User\textsubscript{i} is the basic information of customer i, such as transaction amount, transaction frequency, etc; Comment\textsubscript{it-1} is the current review behaviors of customer i, such as the number of reviews and the cumulative reviews contribution, etc. \( \beta, \gamma, \delta \) are three independent variables, \( \varepsilon_{it} \) is the stochastic error term, representing the potential impact of dependent variable in the model and meeting the assumption of \( \varepsilon_{it} \sim N (0, \varphi) \).

Customer churn model without customer’s own review behavior

The prediction model in this section just focus on the customer churn behaviors resulting from customer ’s own factors and customer purchase behaviors. According to the references about E-commerce customer churn at home and abroad, considering various factors affecting customer churn and explaining the availability of variable data, we determine twelve indicators as selected variables to research in this paper, which includes age, gender, customer contribution value, transaction amount, highest transaction amount, transaction frequency, the time of last transaction, the time of first transaction, numbers of transaction during the work time, day, night and midnight as follows:

\[ \text{Churn}_{it} = \beta_1 \text{age}_{i} + \beta_2 \text{gender}_{i} + \beta_3 \text{Contribution}_{i} + \gamma_1 \text{Gm}_{it-1} + \gamma_2 \text{Gtop}_{it-1} + \gamma_3 \text{Gfirsttime}_{it-1} + \gamma_4 \text{Gworktime}_{it-1} + \gamma_5 \text{Glasttime}_{it-1} + \gamma_6 \text{Gday}_{it-1} + \gamma_7 \text{Gnight}_{it-1} + \epsilon_{it} \]  

(3)

Customer churn model including customer own review behavior

Next, we introduce the customer’s own review behaviors, giving a modified prediction model with the consideration of customer’s own factors, customer purchase behaviors and customer review behaviors. On the basis of Formula (3), nineteen indicators have been further put forward with the addition of cumulative review contribution value, the highest review contribution value, review frequency, numbers of review during the work time, day, night and midnight as follows:

\[ \text{Churn}_{it} = \beta_1 \text{age}_{i} + \beta_2 \text{gender}_{i} + \beta_3 \text{Contribution}_{i} + \gamma_1 \text{Gm}_{it-1} + \gamma_2 \text{Gtop}_{it-1} + \gamma_3 \text{Gfirsttime}_{it-1} + \gamma_4 \text{Gworktime}_{it-1} + \gamma_5 \text{Glasttime}_{it-1} + \gamma_6 \text{Gday}_{it-1} + \gamma_7 \text{Gnight}_{it-1} + \gamma_8 \text{Gmidnight}_{it-1} + \gamma_9 \text{Gworktime}_{it-1} + \gamma_{10} \text{Glasttime}_{it-1} + \gamma_{11} \text{Gday}_{it-1} + \gamma_{12} \text{Gnight}_{it-1} + \gamma_{13} \text{Gmidnight}_{it-1} + \gamma_{14} \text{Gworktime}_{it-1} + \gamma_{15} \text{Glasttime}_{it-1} + \gamma_{16} \text{Gday}_{it-1} + \gamma_{17} \text{Gnight}_{it-1} + \gamma_{18} \text{Gmidnight}_{it-1} + \gamma_{19} \text{Gworktime}_{it-1} + \gamma_{20} \text{Glasttime}_{it-1} + \gamma_{21} \text{Gday}_{it-1} + \gamma_{22} \text{Gnight}_{it-1} + \gamma_{23} \text{Gmidnight}_{it-1} + \epsilon_{it} \]  

(4)

EMPIRICAL STUDY

Data Collection

The data used in our work is obtained from a well-known Chinese online review website named “Dian Ping” at Shanghai. “Dian Ping.com” is one of the world’s largest online website with a collection of professional reviews, group purchase and other functions, which can provide user’s basic information, online reviews and group purchase information, etc. We randomly selected group purchase customers from January 1, 2011 to June 30, 2011 and extracted the data of these customer’s purchase behaviors, customer reviews behaviors and demographic characteristics as the independent variables. Meanwhile, we selected the number of group purchase from all above customers from July 1, 2011 to September 30, 2011 and believed that customers without group purchase in this period of time have already churn, denoted as 1;while customers with group purchase in this period of time can be assigned to not churn, denoted as 0. Finally, we obtained 921 users’ group purchase data and review data as the independent variable and dependent variable according to Fig. 2:
Variables and Measurement Values

Table 3. Description of model variables

<table>
<thead>
<tr>
<th>Type</th>
<th>Names</th>
<th>Symbols</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependent variable</td>
<td>Customer churn</td>
<td>Churn</td>
<td>No purchase: 1; Purchase: 0, 2011.7.1-2011.9.30</td>
</tr>
<tr>
<td>Own factors</td>
<td>Age</td>
<td>Age</td>
<td>Male: 1; Female: 0</td>
</tr>
<tr>
<td></td>
<td>Gender</td>
<td>Gender</td>
<td>user's age information</td>
</tr>
<tr>
<td></td>
<td>Contribution value</td>
<td>Contribution</td>
<td>user's overall contribution value</td>
</tr>
<tr>
<td>Purchase behaviors</td>
<td>Cumulative amount</td>
<td>Gm</td>
<td>cumulative amount: 2011.1.1-2011.6.30</td>
</tr>
<tr>
<td></td>
<td>Largest transaction amount</td>
<td>Gm_top</td>
<td>Largest single transaction amount: 2011.1.1-2011.6.30</td>
</tr>
<tr>
<td></td>
<td>transaction frequency</td>
<td>Gf</td>
<td>cumulative transaction number: 2011.1.1-2011.6.30</td>
</tr>
<tr>
<td></td>
<td>time of last transaction</td>
<td>G_lasttime</td>
<td>Days between the time of last transaction and 2011.6.30</td>
</tr>
<tr>
<td></td>
<td>time of first transaction</td>
<td>G_firsttime</td>
<td>Days between the time of first transaction and 2011.6.30</td>
</tr>
<tr>
<td></td>
<td>numbers of transactions during the work time</td>
<td>G_worktime</td>
<td>total number of transactions: Monday to Friday &amp; 9 AM - 5 PM</td>
</tr>
<tr>
<td></td>
<td>numbers of transactions at midnight</td>
<td>G_midnight</td>
<td>total number of transactions during 0-6 o'clock</td>
</tr>
<tr>
<td></td>
<td>numbers of transactions during the day</td>
<td>G_day</td>
<td>total number of transactions during 8-18 o'clock</td>
</tr>
<tr>
<td></td>
<td>numbers of transactions during the night</td>
<td>G_night</td>
<td>total number of transactions during 18-24 o'clock</td>
</tr>
<tr>
<td>Review behaviors</td>
<td>cumulative review contribution value</td>
<td>Cm</td>
<td>cumulative review contribution value: 2011.1.1-2011.6.30</td>
</tr>
<tr>
<td></td>
<td>the highest review contribution value</td>
<td>Cm_top</td>
<td>the highest single review contribution value: 2011.1.1-2011.6.30</td>
</tr>
<tr>
<td></td>
<td>review frequency</td>
<td>Cf</td>
<td>total number of reviews: 2011.1.1-2011.6.30</td>
</tr>
<tr>
<td></td>
<td>numbers of review during the work time</td>
<td>C_worktime</td>
<td>total number of reviews: Monday to Friday &amp; 9 AM - 5 PM</td>
</tr>
<tr>
<td></td>
<td>numbers of review at midnight</td>
<td>C_midnight</td>
<td>total number of reviews during 0-6 o'clock</td>
</tr>
</tbody>
</table>
Dependent variable

“Dian Ping.com” can record each user's purchase history, thus the dependent variable of customer churn behaviors is judged by purchase frequency of customers. In detail, we use “Churn” to show the customer churn behaviors in the next stage, no group purchase denoted as 1 while group purchase denoted as 0.

Independent variable

In this paper, the independent variables are divided into three parts, customer’s own factors, customer purchase behaviors and customer review behaviors, and model I just includes the first two parts while model II take all three factors into consideration. Based on the demographic characteristic factors from “Dian Ping.com”, we believe that customer’s own factors are consist of three variables, i.e. gender, age and overall contribution value. Similarly, there are nine variables for customer purchase behaviors, including cumulative transaction amount (Gm), largest transaction amount (Gm_top), transaction frequency (Gf), the time of last transaction (G_lasttime), the time of first transaction (G_firsttime), numbers of transaction during the work time (G_worktime), midnight (G_midnight), day (G_day) and night (G_night). Finally, we also think that there are seven variables for customer review behaviors, such as cumulative review contribution value (Cm), the highest review contribution value (Cm_top), review frequency (Cf), numbers of review during the work time (C_worktime), midnight (C_midnight), day (C_day), and night (C_night).

Data Description

As the description statistics of model variables shown in Table 4, the mean value of dependent variable Churn is 0.347 which means 65.3% of the customers still purchased in the next stage. In addition, the average age of observations is 28 with a standard deviation of 8.181 which also means that the age of sample is generally small. Meanwhile, the mean value of gender is 0.174 which also suggests that the major customers are female.

<table>
<thead>
<tr>
<th>variable</th>
<th>average</th>
<th>standard deviation</th>
<th>Minimum</th>
<th>maximum</th>
<th>observation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Churn</td>
<td>0.347</td>
<td>0.476</td>
<td>0</td>
<td>1</td>
<td>921</td>
</tr>
<tr>
<td>Gender</td>
<td>0.174</td>
<td>0.379</td>
<td>0</td>
<td>1</td>
<td>921</td>
</tr>
<tr>
<td>Age</td>
<td>28.129</td>
<td>8.181</td>
<td>0</td>
<td>112</td>
<td>921</td>
</tr>
<tr>
<td>Contribution</td>
<td>124.619</td>
<td>187.988</td>
<td>-271</td>
<td>3044</td>
<td>921</td>
</tr>
<tr>
<td>Gm</td>
<td>330.102</td>
<td>590.035</td>
<td>1</td>
<td>5773.8</td>
<td>921</td>
</tr>
<tr>
<td>Gm_top</td>
<td>151.7732</td>
<td>229.059</td>
<td>1</td>
<td>2580</td>
<td>921</td>
</tr>
<tr>
<td>Gf</td>
<td>3.664</td>
<td>4.286</td>
<td>1</td>
<td>42</td>
<td>921</td>
</tr>
<tr>
<td>G_lasttime</td>
<td>49.142</td>
<td>45.904</td>
<td>0</td>
<td>174</td>
<td>921</td>
</tr>
<tr>
<td>G_firsttime</td>
<td>97.701</td>
<td>51.810</td>
<td>0</td>
<td>180</td>
<td>921</td>
</tr>
<tr>
<td>G_worktime</td>
<td>1.993</td>
<td>2.687</td>
<td>0</td>
<td>23</td>
<td>921</td>
</tr>
<tr>
<td>G_day</td>
<td>2.457</td>
<td>3.057</td>
<td>0</td>
<td>29</td>
<td>921</td>
</tr>
<tr>
<td>G_night</td>
<td>0.733</td>
<td>1.388</td>
<td>0</td>
<td>18</td>
<td>921</td>
</tr>
<tr>
<td>G_midnight</td>
<td>0.733</td>
<td>1.388</td>
<td>0</td>
<td>18</td>
<td>921</td>
</tr>
<tr>
<td>Cm</td>
<td>9.219</td>
<td>31.609</td>
<td>0</td>
<td>415</td>
<td>921</td>
</tr>
<tr>
<td>Cm_top</td>
<td>1.195</td>
<td>1.713</td>
<td>0</td>
<td>5</td>
<td>921</td>
</tr>
<tr>
<td>Cf</td>
<td>3.483</td>
<td>11.592</td>
<td>0</td>
<td>183</td>
<td>921</td>
</tr>
<tr>
<td>C_worktime</td>
<td>0.691</td>
<td>3.798</td>
<td>0</td>
<td>53</td>
<td>921</td>
</tr>
</tbody>
</table>
Analysis of Results

Colinearity test

Before building the prediction model, we first carried out the multicollinearity test between the variables, i.e. judging by VIF factor. If VIF > 10, there exists colinearity among variables. As shown in Fig. 3, the VIF factors of transaction frequency (Gf), numbers of transaction during the work time (G_worktime), and day (G_day), cumulative review contribution value (Cm), review frequency (Cf), numbers of review during the work time (C_worktime) are all larger than 10. Thus, there actually exists colinearity among the variables. We adopt the method of stepwise regression for variable processing and selection in order to remove the colinearity among variables and get the key variables of influence factors.

Analysis of model results

At the same time, we divide the overall data set into training set and validation set according to the proportion of 8:2, where 737 users in training set (churn:258, unchurn: 479) and 184 users in validation set (churn:62, unchurn:122).

Table 5. Model result - training set

<table>
<thead>
<tr>
<th></th>
<th>Churn</th>
<th>Model I</th>
<th>Model II</th>
<th>Model III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>0.5566**(0.2186)</td>
<td>0.5634**(0.2194)</td>
<td>.5320**(0.2217)</td>
<td></td>
</tr>
<tr>
<td>Gm_top</td>
<td>0.0010**(0.0004)</td>
<td>.0010**(0.0004)</td>
<td>.0010**(0.0004)</td>
<td></td>
</tr>
<tr>
<td>G_lasttime</td>
<td>0.0093*** (0.0020)</td>
<td>.0093**(0.0020)</td>
<td>.0089**(0.0020)</td>
<td></td>
</tr>
<tr>
<td>Gf</td>
<td>-0.3009*** (0.0506)</td>
<td>-0.3046*** (0.0517)</td>
<td>-0.3406*** (0.1468)</td>
<td></td>
</tr>
<tr>
<td>Cf</td>
<td>0.0032 (0.0083)</td>
<td>-0.0218* (0.0169)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cf*Gf</td>
<td></td>
<td>0.0045** (0.0089)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>_cons</td>
<td>-0.5104*** (0.2080)</td>
<td>-0.5134*** (0.2082)</td>
<td>-0.3817* (0.1757)</td>
<td></td>
</tr>
<tr>
<td>obj.</td>
<td>737</td>
<td>737</td>
<td>737</td>
<td></td>
</tr>
<tr>
<td>LR chi2(5)</td>
<td>142.64</td>
<td>142.78</td>
<td>147.79</td>
<td></td>
</tr>
<tr>
<td>Count R2</td>
<td>0.712</td>
<td>0.707</td>
<td>0.712</td>
<td></td>
</tr>
</tbody>
</table>
Table 5 gives the analysis results of training set by Logit model, where model I corresponds to Formula 3 and model II, model III are related to Formula 4. By analysis the result of model I, we find that customer gender ($\beta_1=0.5566$), largest transaction amount ($\delta_2=0.001$), the time of last transaction ($\gamma_4=0.0093$) and transaction frequency ($\gamma_3=-0.3009$) will significantly influence the customer churn behaviors in the next stage, if only considering the customer’s own factor and current purchase behaviors. Moreover, the largest transaction amount ($\gamma_2G_{m\_top \_t-1}$) has a significant positive impact on customer churn behaviors. The higher the largest transaction amount is, the greater possibility a customer will churn in the next stage. However, transaction frequency has a significant negative impact, which also indicates that higher transaction frequency will result in higher use viscosity to websites and lower customer churn behaviors in the next stage. The time of last transaction also has a significant positive impact with a performance of larger time interval leading to higher customer churn behaviors possibility.

By the comparisons of model II and model III, we find that the introduction of customer review frequency has no significant impact on the customer churn behaviors in the next stage, when considering customer’s own factors, current purchase and review behaviors together. However, the effect of customer review frequency on the review platform turns into significant, when we further consider the cross term of transaction frequency and review frequency. This result suggests that the effect of customer review frequency on customer churn behaviors strongly depends on customer transaction frequency in the platform of group-buying. In detail, the synthetic effect (separate influence coefficient + Cross influence coefficient * transaction frequency) of review frequency is -0.005, i.e., the higher review frequency is, the lower customer churn behaviors will happens. In summary, we build the ultimate prediction model as shown in Formula 5:

$$Churn_{it} = \beta_3 gender_{it} + \gamma_2 G_{m\_top \_t-1} + \gamma_2 G_{f\_t-1} + \gamma_3 G_{last\_time_{t-1}} + \delta_3 C f_{t-1} + \delta_3 C f_{t-1} \ast G f_{t-1} + \epsilon_{ijt}$$ \hspace{1cm} (5)

Comparison of model prediction accuracy

By far, the most direct way to evaluate the prediction results is to use the quantitative standards for assessment. Here, we adopt the hitting rate of prediction as the standard on the basis of actual conditions. As shown in Table 6, A, B, C and D can be differentiated by churn or un-churn both in fact and prediction, A and D stands for the successful predictions.

Thus the equation of prediction hitting rate can be written as:

$$\text{Hitting rate} = \frac{A}{A+C}$$ \hspace{1cm} (6)

Obviously, we find the hitting rates of mode III is superior to those of mode I with respect to both training set and validation set in Table 7.

Ten-fold Cross Validation

Due to the small amount of data, we use the Ten-fold Cross Validation method to further validate model, which is suit for small sample. The concrete method is as follow: firstly, the training set of 258 churn samples and 479 non-churn samples are divided into 10 parts, the first nine parts each contain 74 samples, and the last one contain 71 samples. Secondly, we calibrate the
model using the first nine parts samples, and build the logit regression model using the last part sample, which leads to ten models. Thirdly, we apply the ten models into the ten training sets to get the error rate of each model. The overall training set error rate is the average of the above ten error rates. In the same way, we can get the overall error rate of validation sets. The results are reported in Table 8.

| Error number (error) | Training sets | Validation sets | | | |
|---|---|---|---|---|
| | Model I Own + Purchase | Model III Own + Purchase + review | Model I Own + Purchase | Model III Own + Purchase + review |
| (1) | 16 (22.5%) | 16 (22.5%) | 61 (33.2%) | 61 (33.2%) |
| (2) | 23 (31.1%) | 22 (29.7%) | 61 (33.2%) | 60 (32.6%) |
| (3) | 17 (23.0%) | 15 (20.3%) | 63 (34.2%) | 61 (33.2%) |
| (4) | 28 (37.8%) | 21 (28.4%) | 62 (33.7%) | 59 (32.1%) |
| (5) | 28 (37.8%) | 25 (33.8%) | 61 (33.2%) | 56 (30.4%) |
| (6) | 21 (28.4%) | 16 (22.5%) | 63 (34.2%) | 54 (29.3%) |
| (7) | 29 (39.2%) | 26 (35.1%) | 62 (33.7%) | 60 (32.6%) |
| (8) | 17 (23.0%) | 17 (20.3%) | 61 (33.2%) | 57 (31.0%) |
| (9) | 18 (24.3%) | 21 (28.4%) | 54 (29.3%) | 57 (31.0%) |
| (10) | 21 (28.4%) | 18 (24.3%) | 62 (33.7%) | 61 (33.2%) |
| Average error rate | 29.55% | 26.53% | 33.16% | 31.86% |
| Original error rate | 29.72% | 29.17% | 32.07% | 31.52% |

To sum up, the difference between average error rate and original error rate is very small using the Ten-fold Cross-validation method to analyze the training sets as well as validation sets in Model I & Model III, which shows the stability of our customer churn prediction model.

**CONCLUSION**

The main purpose of this article is to study the impact of customer’s review behavior on its purchase behavior and try to understand how to utilize this effect to predict customer’s churn behavior in the next stage. Based on the data from Dianping.com, we build the Logit regression model to analyze the effect of review platform on group-buying platform, and use ten-fold cross-validation to prove the stability of our model. The main results are as follows: Firstly, different from the traditional research, we combine the customer’s own review behavior and purchase behavior to build the churn prediction model, considering customer’s own factors, review behavior and the effect of review behavior on its next stage purchase behavior. We discover that there is an effect of customer’s own review behavior on its purchase behavior, which depends on the cross term of purchase frequency and review frequency. The more review times, the less possibilities to churn in the next stage, which demonstrate the effect of review platform on group-buy platform. Secondly, we improve the customer churn prediction model, introducing the customer review frequency on group-buy platform to the prediction model, which promotes the accuracy of prediction.

There are some limitations for this research. Due to the amount of data, we did not consider the effect of public purchase and...
review behavior on customer’s own churn behavior. In the future research, we should further expand the sample size, and add more factors to refine the prediction model for further analysis.

ACKNOWLEDGEMENTS
This paper was supported by the National Natural Science Foundation of China (No.: 71171023, 71231002), Major State Basic Research Development Program of China (973 Program) (No.: 2012CB315805, 2013CB329604), Research Fund for the Doctoral Program of Higher Education of China (No.: 20120005110015).

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EFFECTS OF SUPPLY CHAIN STRATEGIES AND PRACTICES ON FIRM PERFORMANCE

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ABSTRACT
A number of studies have looked at the impacts of supply chain strategies on firm performance. Yet, how different supply chain practices translate to firm performance remains unclear. Drawing from the resource based view, this study investigates the role of supply chain capabilities in mediating the relationships between supply chain practices and firm performance. A survey was conducted with 171 manufacturing firms in five Chinese cities to empirically validate the research model. Our findings suggest that, supply chain practices, as driven by supply chain strategies, create different supply chain capabilities and lead to firm performance. The findings shed some lights on the mechanism in which supply chain strategies and practices translate into firm performance.

Keywords: Resources Based View, Supply Chain Strategies, Supply Chain Practices

INTRODUCTION
Supply chain management (SCM) has become an essential prerequisite to staying in the competitive global race and to growing profitably [35] [42], the concept of SCM has got increasing attention from academicians, consultants, and business managers [12] [24] [33]. In academics, many research works have been conducted to examine the relationships of various SCM practices and firm performance [10] [48] [55].

While the relationships between supply chain strategies on firm performance have been examined extensively e.g., [16] [22], evidence of their impacts on firm performance through implementing different supply chain practices and developing different supply chain capabilities is limited and inconclusive [22]. The overall objective of this study is to investigate the impacts of different supply chain strategies on firm performance, through the implementation of different supply chain practices which lead to the development of different operation capabilities.

THEORETICAL BACKGROUND AND CONCEPTUAL FRAMEWORK
The resources based view of the firm is among the most widely used theoretical framework for studying the impacts of supply chain strategies on firm performance e.g., [9, p.11–13]. The resources based view complements traditional industrial organizational theory by recognizing the competitive value of resources/capabilities and how they together with strategies determine a firm’s long term performance [4] [22].

In supply chain management, the relationships between supply chain strategies and practices on firm performance have been examined extensively [16] [37] [43]. Yet, the role of capability and its impact on firm performance is limited and inconclusive [22]. We propose that the impacts of supply chain strategies on firm performance can be explained by the supply chain practices as driven by the supply chain strategies, and the supply chain capabilities developed through the supply chain practices. The proposed framework is depicted in Figure 1.

Figure 1 Conceptual Framework

Supply Chain Strategy, Practices, Capabilities, and Firm Performance
Fisher [17] proposed two fundamental supply chain strategies, labeled as physically efficient and market-responsive. Following his work, subsequent studies focused on two supply chain strategies – lean and agile. Lean supply chain strategy (roughly equivalent to Fisher’s physically efficient strategy) focuses on reducing cost and enhancing efficiency through
elimination of wastes [43]. Such strategy is best matched with a relatively stable environment where demand and supply uncertainties are low. Under such environment, companies practice their best to eliminate the no-value-added activities and pursue scale economies, and they deploy optimization techniques to get the best capacity utilization in production and distribution [30].

Agile supply chain strategy (roughly equivalent to Fisher’s market-responsive strategy), focuses on providing customer-driven products with unique features to the market quickly in order to maintain a competitive advantage in a rapidly changing environment [30] [43]. In a dynamic and turbulent environment, agility can help companies to respond to short-term changes quickly and manage the external disturbance easily [11] [30] [53].

The two fundamentally different supply chain strategies arguably lead to different supply chain practices [22]. Different supply chain practices, as driven by different strategies, impact overall firm performance through improving specific aspects of supply chain operations such as cost savings, product delivery, customer service [33] [43]. This is in line with the resource based view that links a firm strategy to performance through the development of firm-specific capabilities. Such capabilities refer to the tasks and activities at which firms must excel in support of corporate objectives [13] [22] [44].

**HYPOTHESES DEVELOPMENT**

Different types of supply chain strategies have different impacts on supply chain practices. SCM practices refer to the set of activities undertaken in an organization to promote effective management of its supply chain [33]. These practices cover both external and internal activities of the supply chain. For external SCM practices, supplier side (upstream) SCM practices include those activities related to deal with suppliers including purchasing management [3] [24] [29], supplier relationship [7] [14] [23] [33], supplier development [10] [27] [52], supplier involvement [8] [51] and supplier alliance [2] [34] [36] [56], whereas customer side (downstream) SCM practices include demand management, customer services management and customer relationship [24] [33], most of which are related to the activities in dealing with customers.

Internal SCM practices refer to the activities related to manufacturing and production processes including lean production [25] [31] [32] [40] [45] [55], agile manufacturing [6] [20] [28] [54], and other activities such as IT and information sharing [1] [8] [14], geographical proximity [48], postponement [15] [33] [41]. A company’s internal SCM practices are heavily influenced by its supply chain strategies [38] [43] [48].

Lean supply chain strategy requires that manufacturers make cost reduction their first priority. Lean strategy leads to lean practices, defined as “the practices of eliminating waste (cost, time, etc.) in a manufacturing system, characterized by reduced set-up times, small lot sizes, and pull-production” [33]. Adopters of lean strategy implement lean practices such as mass production, just-in-time, and long-term supplier relationships to eliminate waste and achieve a lower cost [43].

Conversely, agile supply chain strategy emphasizes flexibility and responsiveness by creating more capability buffers to handle the market volatility [43]. Agile strategy leads to agile practices, defined as “the capability of surviving and prospering in a competitive environment of continuous and unpredictable change by reacting quickly and effectively to changing markets, driven by ‘customer-defined’ products and services” [9]. Adopters of agile strategy implement agile practices such as modularization techniques, concurrent production activities, empowerment of decision making, cross functional teamwork and multi-skill training [9] [19] [33]. Hence, we hypothesize that:

H1: Lean supply chain strategy has a positive association with the use of lean supply chain practice.

H2: Agile supply chain strategy has a positive association with the use of agile supply chain practice.

It was suggested that influence of different supply chain strategies, which lead to different supply chain practices, on firm performance was attained through enhancing different supply chain capabilities. Lean strategy, which leads to lean practices, enhances cost-related capabilities such as cost savings, whereas agile strategy, which leads to agile practices, enhances flexibility-related capabilities in terms of delivery [33] [43]. Furthermore, agile practices represent not only a kind of capability that can response quickly and effectively to the changing market and changing customer needs but also it represents a kind of market (or customer) oriented management philosophy [19] [20] [26]. As a result, agile practices can help firms improve flexibility and customer service [43]. Bayraktar et al. [5] has found that, supply chain management practices, in general, have a positive impact on operational performance. Sukwadi, Wee, and Yang [47] has found that lean and agile supply chain practices leads to better supply chain performances, which include such dimensions as responsiveness and expenses. Hence, we hypothesize that:

H3: Lean supply chain practice has a positive impact on cost savings.

H4: Agile supply chain practice has a positive impact on (a) responsiveness and (b) customer service.

H5: Firm performance is positively associated with (a) cost savings, (b) responsiveness and (c) customer service.
RESEARCH SETTINGS
Following the suggestion of Qi et al.’s work that we select the target cities in which the manufacturing companies are relatively better developed and the SCM concepts are better established than other areas in China [43]. As a result, we chose five representative cities in Pearl River Delta regions, which are well known as global manufacturing. To make our sample be more representative, we mainly include electronics and telecommunications, electricity and machinery, appliance, garment and textile, automobiles, chemicals, foods and beverage as the main industries.

Data Collection
Based on these geographical and industrial criteria, we use a database provided by Guangdong Shikang Information Service Limited, who provides us a database of Guangdong Manufacturing Firms. As suggested by Li et al. [33], manufacturers with fewer than 100 employees seldom engage in sophisticated supply chain management. Still the sampling list is too large to manage if we set the edge of the numbers of employees in the companies; thus, we only include those companies with 200 or more employees to participate in our survey.

Data are collected via field visits. Following the contacts listed, 1780 companies were contacted by telephone or email and finally 212 agreed to do the survey. However, 22 of them have less than 200 employees. We exclude them from our analysis. Another 19 companies have not filled in all the necessary information. Therefore, we have 171 companies in our final sample.

The unit of analysis is the manufacturing firms in the five cities mentioned above. Supply chain manager, operations manager, CIO, general manager and experienced staff (who have more than 3 years working experience in the target company) were selected as potential respondents for this study. They are assumed to have good knowledge about their SCM practices. A significant problem with organizational-level research is that senior and executive-level managers receive many requests to participate and have very limited time [43] to participate in such kind of survey. To improve the quality of the data, we directly go to the targeting companies to interview the respondents instead of using email or fax.

Variable Operationalization
In this study, we employed literature in information systems, operations management and sociology as our references to develop proper measurements in the questionnaire. The review process provides us a basis for measurement development and reliability assurance of most of the variables used in the questionnaire. Measurements for variables were adapted from existing literature whenever possible, except for agile practices, which were newly developed. We follow the principles of agile manufacturing (including concurrent engineering, empowerment of decision making, multi-skilled workforce, cross-functional teams etc.) defined by Gunasekaran [19] and develop the measurement items for agile practices. Except those demographic questions like company size, ownership, numbers of employees, most measure are composed of multi-statements in which the respondents are required to rate their responses from 1 (strongly disagree) to 5 (strongly agree).

Supply chain strategies is defined as “the pattern of decisions related to sourcing products, capacity planning, conversion of raw materials, demand management, communication across the supply chain, and delivery of products and services” [38]. In this study, we adapt the measures from Qi et al.’s [43]. Measures for supply chain capabilities (i.e. cost savings, responsiveness, and customer service) are based on items adapted from Qi et al. [43] that measure the extent to which the company is better than its competitors in terms of these capabilities. Measures for financial performance are based on six items commonly used in the literature [21] [43] [50]. It measures the extent to which the company performs better than its competitors in terms of return of investment (ROI), return on assets (ROA), market share, growth in ROI, growth in ROA, and growth in market share.

Profiles of Surveyed Companies
In our survey, we only include those companies who had more than 200 employees. 46.2% of the responding companies had 200 to 499 employees, 19.9% had 500 to 999 employees, and 39.1% had over 1000 employees. The following table (Table 1) shows the industrial distribution of our sample.

<table>
<thead>
<tr>
<th>Industry</th>
<th>Sample</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food, Beverage &amp; Medicine</td>
<td>5</td>
<td>2.92</td>
</tr>
<tr>
<td>Textile, Garments, Footwear &amp; Leather</td>
<td>26</td>
<td>15.20</td>
</tr>
<tr>
<td>Papermaking, Papet Products &amp; Printing</td>
<td>13</td>
<td>7.60</td>
</tr>
<tr>
<td>Cultural, Educational and Sports Articles</td>
<td>7</td>
<td>4.09</td>
</tr>
<tr>
<td>Raw Chemical Materials and Chemical Products</td>
<td>5</td>
<td>2.92</td>
</tr>
<tr>
<td>Metal &amp; Plastic Products</td>
<td>11</td>
<td>6.43</td>
</tr>
</tbody>
</table>
Assessing Reliability and Validity
Partial Least Square (PLS) was used to assess both the measurement model and to test the path model.

The measurement items are assessed in terms of reliability and construct validity. The composite reliability of the measurement scales range from .85 to .92 which is higher than the required level of 0.7. Construct validity is assessed using confirmatory factor analysis (CFA). Convergent validity is established if the average variance extracted (AVE) is over the edge value 0.5. Discriminant validity is established if the AVE of the factor is greater than the square of the correlation between that factor and other factors [18]. All AVE are higher than 0.5 and the square root of AVE of the factor is much lower than the correlation between the factors and other factors. This demonstrates the convergent and discriminant validity of the measurement scales.

RESULTS OF THE PATH MODEL AND DISCUSSION
The results of the PLS analysis of the path model are reported in Figure 2. Lean strategy was found to be positively associated with lean practice. Similarly, agile strategy was found to be positively associated with agile practice. Hence, both H1 and H2 are supported. However, our results suggest a positive association between lean strategy and agile practice. This is in line with the literature that lean and agile strategies are not mutually exclusive [11] [49]. In this case, companies pursuing primarily considered a lean supply chain strategy may also implement practices that are theoretically associated with an agile supply chain strategy. Yet, those practices may also provide benefits that are empirically associated with a lean supply chain strategy. In other words, supply chain practices that primarily enhance responsiveness and flexibility may enhance cost savings as well. Therefore, such practices may be implemented by companies pursuing a lean supply chain strategy.

Lean practice, as driven by lean strategy, was found to have a positive impact on cost savings, hence supporting H3. Agile practice, as driven by agile strategy, was found to have a positive impact on responsiveness, hence supporting H4a. However, the positive effect of agile practice on customer service was statistically insignificant. Hence, H4b is not supported. Upon further investigation, it was found that responsiveness has a significant impact on customer service, suggesting that the impact of agile practice on customer service is an indirect one through responsiveness.

The three supply chain capabilities, i.e. cost savings, responsiveness, and customer service, were hypothesized to have positive impacts on financial performance. Our results show significant impacts of cost savings and customer service on financial performance, hence supporting H5a and H5b. The impact of responsiveness of financial performance is insignificant, hence H5c is not support. However, with the direct impact of responsiveness on customer service described above, our results suggest an indirect impact of responsiveness on financial performance through customer service.
Consistent with the resource based view, our research model suggest that different supply chain practices, as driven by different supply chain strategies, influence firm performance through creating different supply chain capabilities.

Using resource based view as the theoretical foundation; this study contributes to the literature in terms of how different supply chain strategies and practices translate into firm performance. By understanding the supply chain capabilities developed by the implementation of different supply chain practices, companies would be able to better management their supply chain given the supply chain strategies pursued. Moreover, previous inconclusive results of the effect of SCM practices on firm's performance may due to the fact that the capability factors are not included in the analysis. As the SCM capability may be affected by other factors, excluding the capability may lead to inconclusive result.

The results of the study should be interpreted together with its limitations. The data used in this study was collected in China, and cultural factors may affect the generalizability of the findings to other countries. Also, the cross-sectional design of the study does not allow us to pinpoint the relationships among the supply chain strategies, practices, capabilities, and firm performance. Future studies are encouraged to replicate our findings to determine the generalizability of the findings to other countries.

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EFFECTS OF THE INTERNET OF THINGS (IOT): A SYSTEMATIC REVIEW OF THE BENEFITS AND RISKS

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ABSTRACT

The Internet of Things (IoT) might yield many benefits and can be transformative in nature, yet has been given scant attention in e-commerce literature. The IoT describes a situation whereby physical objects are connected to the Internet and are able to communicate with, and identify themselves to other devices. These devices generate a huge amount of data. When it is possible to combine data from devices and other systems, new insights may be created which may provide important benefits to e-commerce. The duality of technology predicts that the accomplishment of benefits might also cause risks. In this paper we conduct a systematic review of literature to create an overview of perceived benefits and risks of IoT. The results confirm the duality that IoT has a variety of expected political, strategic, tactical and operational benefits as well as interrelated risks attached to its adoption. However, risks regarding the adoption of IoT also occur at all levels. Accomplishment of benefits requires that possible risks need to be mitigated in concert.

Keywords: Internet of Things, IoT, adoption, open data, e-commerce, smart cities, impediments, barriers, challenges, benefits, advantages

INTRODUCTION

The term, the Internet of Things (IoT) refers to the increasing network of physical objects that feature an IP address for internet connectivity, and the communication that occurs between these objects and other Internet-enabled devices and systems [8][21][33]. IoT makes it possible to access remote sensor data and to monitor and control the physical world from a distance, allowing many physical objects to act in unison, through means of ambient intelligence [33]. These devices, and the communication between these devices, can benefit e-commerce by providing enough quality data to generate the information required to make the right decisions at the right time.

IoT can be used to enrich e-commerce by enabling a technology-mediated relationship between stakeholders. According to Daniel, Wilson, and Myers (2002), e-commerce encompasses not only “the buying and selling of information, products and services via computer networks” [24 p.254] but also, the use of Internet technologies to exchange or share information within the organization or with external stakeholders. IoT can have important implications for e-commerce to improve the client experience and ensure reliable product delivery. The data may be combined in new, creative ways to be used for commercial gain.

Research in the sociology of technology suggests that the evolution of new applications is a process of social interaction between multiple agents [2]. The duality of technology theory [28] describes technology as assuming structural properties whilst being the product of human action. Technology is physically constructed by actors in a social context, and socially constructed by actors through the different meanings they attach to it. A crucial aspect of human action is that it is knowledgeable and reflexive. According to Orlikowski (1992), agency refers to capability not intentionality, although action taken by actors may have unintended consequences. As such IoT implementations may also bring with them unintended consequences such as the misuse of surveillance or telecom data which disregards personal privacy, or on the positive side, the use of sensor data in “Big Data” applications which provide insight into issues other than those for which the sensor was placed in the first place. The dual nature suggests that IoT might have positive impacts and it could also exert negative effects when not designed properly. We will view this as the risks that might occur.

The methodology used in this research is described in section two. On the basis of state of the art literature an initial list of benefits and risks will be derived in section three. The potential benefits of IoT will be presented followed by the risks. The results show that IoT has a variety of potential strategic, tactical and operational benefits and risks. This implies that IoT enables effective knowledge management, sharing and collaboration between domains and divisions at all levels of the organization, as well as with external partners. However, these benefits do need to be weighed against the potential risks of IoT adoption. Finally, conclusions will be drawn in section four.

RESEARCH METHOD

The common benefits and risks of IoT were identified from a rigorous review of literature. In August 2015, the keywords: “Internet of Things”, (“benefits” or (“impediments” or “barriers”)) and “e-commerce”, returned four hits within the databases Scopus, Web of Science, IEEE explore, and JSTOR, of which three were considered relevant to this research. This confirmed the limited amount of e-commerce literature addressing this topic. The query [all abstract: "internet of things" “benefits” “impediments” “barriers” "e-commerce"] searching between 2000 and 2015 returned five hundred and thirty-nine hits in Google Scholar. We then filtered these results and performed a forward and backward search and selected thirty-three relevant articles based on the criteria that they specifically referred to potential benefits or risks with regards to the use or implementation of IoT within potential e-commerce applications. The resulting risks and benefits found in the literature were perceived benefits and risks and it was not clear if they actually could be found in practice and how the benefits and risks are
interrelated. In the literature benefits and risks are often assumed to occur, but there was no systematic account of the evaluation in practice and if they were actually accomplished. The expected benefits and risks of the IoT for e-commerce are expressed in italics within this paper.

LITERATURE REVIEW

The main enabling factor for the IoT is the blending integration of several technologies and communications solutions such as identification and tracking technologies, wired and wireless sensor and actuator networks, enhanced communication protocols (shared with the Next Generation Internet), and distributed intelligence for smart objects [3], Radio Frequency Identification technology, Electronic Product Code technology, and ZigBee technology [10]. By installing apps on a mobile phone or tablet the device can become a sensor in a large network. For example, accelerometers can be used to detect potential potholes when persons are cycling or driving. Cameras and microphones can be used to collect evidence when there is a robbery or a riot and devices can measure the concentration of fine particles. Sensors can be used for enabling public safety and compliance to regulations for example. In this way it may provide a more effective control mechanism [3][7][10][11][17].

Potential Benefits

IoT results in a large amount of big data. Literature shows that this might have two important benefits for e-commerce [9]. Firstly, making data and information available to the public greatly improves government transparency [9]. Increased openness and transparency helps ensure proper oversight and reduces government waste. Secondly, enabling consumer self-service in this way can empower citizens and business to take decisions through better access to information by making use of the vast amount of data collected by IoT and the collective wisdom of the crowds [3][7][10][14][17][21][12]. The IoT gives intelligent advice to users. For example, in intelligent transportation systems such as in-car intelligent driving systems and smart highways, route planning assists drivers by considering constraints related to traffic, time, and cost [21][33].

Fleisch (2010) identifies seven value drivers for the IoT which result in potential business benefits: 1. The “simplified manual proximity trigger” increases job satisfaction, empowers consumers by enabling consumer self-service, reduces labor costs and improves data quality [5]; 2. the “automatic proximity trigger” reduces fraud related costs, process failure costs, and labor costs, and provides high granularity data for improved efficiency through process improvement; 3. the “automatic sensors trigger” helps improve service quality by providing individual and prompt process control, increases process efficiency and effectiveness, and provides an additional level of data quality for identifying potential areas for further process improvement; 4. automatic product security reduces cost of process failure due to fraud, reduces the cost of process security and helps increase consumer trust; 5. simple, direct user feedback improves service efficiency and effectiveness by helping processes become more accurate, more flexible, and faster; 6. extensive user feedback improves trust by ensuring new customer contact, providing new advertising opportunities and supporting additional service revenues; 7. mind changing feedback allows for the identification of trends, enabling new product features and new services, and enables an active selection of attractive customer segments [14].

Another view of possible IoT application classification is provided by [11]. Chui et al. (2010) define two broad categories for IoT applications, Information and Analysis and Automation and Control. In Information and Analysis, decision making services are improved by receiving better and more up to date information from networked physical objects which allows for a more accurate analysis of the current status quo with regards to tracking, situational awareness, and sensor-driven decision analytics. In Automation and Control, outputs received from processed data and analysis are acted upon to improve efficiency, effectiveness and to enforce compliancy.

Haller et al. (2009) draw on the work of Fleisch et al. (2006) and identify two major paradigms from which business value can be derived: real-world visibility, and business process decomposition. Haller et al. (2009) believe that with real-world visibility, sensors make it possible for a company to better know what actually is happening in the real world. The use of automated identification and data collection technologies such as RFID enables an increased accuracy and timeliness of information about business processes and provides competitive advantages through improved service efficiency in terms of process optimization [39]. This may allow for more system flexibility in which the system is better able to react to dynamic changes [39].

According to Harrison (2011), the benefits of IoT technologies for commerce and e-commerce are primarily derived from the availability of more granular information which is automatically collected and readily shareable soon after it is generated [20][41]. This provides better analysis of track and trace information, and helps balance supply and demand [20]. Ubiquitous computing and grid computing can be applied to network manufacturing resources [5]. Data can be acquired promptly and readily shared by all decision-making units.

In short, IoT can deliver a variety of benefits related both to the real-time measurement and analyses of sensor data efficiency of services, improved effectiveness of services, and improved flexibility of services as to trend analysis of historical data over time. We list the possible benefits of IoT according to strategic/political, tactical and operational divisions. This is a popular divisioning [1][23], suitable for e-commerce research. Possible benefits of the IoT are: 1. Political and Strategic - improved forecasting and trend analysis, promoting government transparency, improved citizen empowerment; 2. Tactical - improved planning with regards to management and maintenance, more efficient enforcement of regulations, improved health and safety.
measures, cost reduction, new revenue streams; 3. Operational - improved efficiency of services, improved effectiveness of services, improved flexibility of services.

Potential Risks
Organizations are increasingly turning to the IoT as new sources of data, which are derived from continuously monitoring a wide range of things within a variety of situations, become available. However, there are several technological and regulatory challenges that need to be addressed. Scarfo (2014) believe that the most important of them are related to data ownership such as security, privacy and the sharing of information [36]. It is clear that the implementation of IoT for e-commerce faces a variety of impediments. Skarmeta et al. (2014) consider security and privacy to be the main obstacles for a full acceptance of IoT. The sensitivity levels of the information are a crucial aspect to be considered by the access control mechanism. Disclosure of user data could reveal sensitive information such as personal habits or personal financial information. The unauthorized access to this information can severely impact user privacy [13][22][36][37][43][44]. In this way, IoT requires novel approaches to ensure the safe and ethical use of the generated data [35], requiring a strong data governance [16][22][36][40][43]. A weak form of data governance can impede the safe and ethical use of data generated by IoT devices.

According to Misuraca (2009), IoT brings with it a wealth of new business opportunities. There is enormous scope for developing applications and selling new services [26]. But a lack of, or poorly coordinated, policy and regulations regarding IoT can also greatly impede the implementation and application of IoT. Organizations need to develop policy and regulations and position themselves carefully within this arena [19][40][43]. In this regard, organizations should consider the role they play in enabling IoT development very carefully. Market forces of supply and demand can play substantial roles in the success or failure of IoT [13][26][32][42]. For example, according to Qiao et al. (2012) the IoT industry will demonstrate an inevitable outbreak growth at the growth stage of the Industry Lifecycle Theory [4].

Although reduction in overall costs is an often cited benefit of IoT for e-governance [8], many researchers also cite high development and implementation costs as an important impediment to the implementation and application of IoT [13][19][27][32][43]. According to Yazici (2014), high maintenance costs are often rated as the largest impediments to IoT implementation. A fully functional IoT system based on RFID technology can be substantial. By way of example, Yazici (2014) quotes Wal-Mart’s vendors as having spent US$1 to US$3 million on a RFID implementation.

Furthermore, the Internet of things is more than one device, application or network. In order to ensure sustainable connectivity, all interfaces and communication protocols require unified industry standards [13]. However, Fan et al. (2014) believe that the large number of standards-setting organizations has led to a situation in which the top standard has not yet been set. Vendors are free to choose which standard they find best fits their production line, leading to a wide variety of available types. This may impede interoperability and integration of data [6][13][19][36][40]. IoT requires that a large number of devices be integrated with the existing Internet. These devices can be diverse in terms of data communication methods and capabilities, computational and storage power, energy availability, adaptability, mobility, etc. Heterogeneity at the device level is a serious impediment to IoT adoption.

According to Zeng et al. (2011), Universal Plug and Play (UPnP) is currently the most popular solution for personal network implementation. However, there is no authentication protocol proposed for UPnP. All devices are allowed to configure the other devices on the personal network, without any user control. This can result in a critical security issue when the smart things become available on the Internet. The attention given to security by a number of authors [13][19][22][36][37][44] suggests that a lack of security standards is becoming a serious impediment to IoT implementation. Whilst there are many standard technologies and protocols to address many security threats, the severe constraints on the IoT devices and networks prevent a straightforward implementation of these solutions [37]. Furthermore, IoT devices generally have to work in harsh, uncontrolled environments, where they may be prone to attacks, misuse or malicious intentions [37].

According to Kranenburg et al. (2014), the success of user-centric services based on IoT technology depends primarily on people participating and sharing information flows [25]. Willingness on the part of people to participate in these systems is therefore required [13][16][27][29][38][42][44]. Kranenburg et al. (2014) believe that this willingness is predominantly dependent on the perception of people: the perceived trust and confidence in IoT and the perceived value that the IoT generates for them. The greater the trust of users in the IoT, the greater their confidence in the system and the more willing they will be to participate [25]. A lack of trust in the system can be a strong impediment to the effectiveness of IoT.

Operational barriers include human capital issues such as difficulty in employing qualified personnel, lack of specialists, and personnel skill shortage to operate new applications [38][43], [19], as well as insufficient IoT oriented training and educational activities [19]. Harris et al. (2015) also identify personnel reluctance to change or to learn new technology as a barrier. A lack of understanding about how IoT works, the possible benefits, and how to make the business case for IoT implementation were also found to be barriers by a number of researchers [30][34][38][43]. Reyes et al. (2012) includes calculating the return on investment and the payback period in this category [34]. Operational barriers also include technical issues such as limitations in information technology (IT) infrastructural capabilities [13][22][25][31][36][42][44].

Data management issues are also of concern. Organizations are often faced with a complex legacy of data and applications.
when implementing IoT solutions [16]. Many organizations may have several generations of systems running in parallel, and much of the data fed into the system has been done manually, with associated risks in terms of data quality [6][16][40].

In short, IoT faces a variety of barriers related to the proper use (privacy and security for example) and proper management of the data collected by the vast number of interconnected things. Strategic/political barriers are: data privacy issues, data security issues, weak or uncoordinated data policies, weak or uncoordinated data governance, and conflicting market forces. Tactical barriers include: costs, interoperability and integration issues, acceptance of IoT, and trust related issues. Operational issues are: a lack of sufficient knowledge regarding IoT, IT infrastructural limitations, and data management issues.

Table 1. Summary of Benefits and Risks

<table>
<thead>
<tr>
<th>Benefits</th>
<th>Risks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improved forecasting and trend analysis [11][14][20],</td>
<td>Data privacy [13][22][25][36][37][43][44], data security</td>
</tr>
<tr>
<td>Promoting transparency [3][7][9][10][17][21],</td>
<td>[13][19][22][25][29][36][37][43][44], Weak/uncoordinated data policy</td>
</tr>
<tr>
<td>Customers/citizen empowerment [3][7][9][10][12][14][17][21]</td>
<td>[19][26][40][43], Conflicting market forces[13][26][32][42],</td>
</tr>
<tr>
<td></td>
<td>Non-compliance to regulations[16][22][36][40][43]</td>
</tr>
<tr>
<td>Improved planning [7][14][21][33], more efficient enforcement of</td>
<td>Costs[13][19][27][32][43], interoperability and integration</td>
</tr>
<tr>
<td>regulations [3][7][10][11][17], Improved health and safety measures</td>
<td>[6][13][19][36][40][42], Acceptance of IoT</td>
</tr>
<tr>
<td>[7][21], Cost reduction [5][14][18], New revenue streams [5][18]</td>
<td>[13][16][25][27][38][42]–[44], Trust related issues [25][42][44]</td>
</tr>
<tr>
<td>Improved efficiency of services [7][11][14][18][20][21][33][41],</td>
<td>Lack of sufficient knowledge [38][43], IT infrastructure limitations</td>
</tr>
<tr>
<td>Improved effectiveness of services[7][11][14][18][20][21][33][41],</td>
<td>[13][22][25][29][31][36][42]–[44], Data management issues[6][16][27][36][44]</td>
</tr>
<tr>
<td>Improved flexibility of services [7][11][14][18][20][21][33][41]</td>
<td>Incorrect data [22][36][40]</td>
</tr>
<tr>
<td>Real-time monitoring [14][15][20][21][33][41]</td>
<td></td>
</tr>
</tbody>
</table>

The literature emphasized the benefits of IoT and fewer risks were found. The benefits in the literature were often assumed benefits and whether or not they were actually accomplished was not clear.

CONCLUSION

The IoT makes it possible to access remote sensor data and to monitor and control the physical world from a distance. Furthermore, combining and analyzing captured data also allows organizations to develop and improve services which cannot be provided by isolated systems. Although there has been limited research in the field of e-commerce about IoT, our review shows the main focus has been anecdotal and till now has focused on the benefits. The research shows that benefits range from the political to the operational level. Specifically benefits for e-commerce can be attributed to improved efficiency, effectiveness and flexibility of services; reduction of costs; improved citizen empowerment; improved government transparency; more efficient enforcement of regulations; improved planning and forecasting; and improved health and safety measures. The IoT makes it possible to access remote sensor data and to monitor and control the physical world from a distance. There are the future consequences that can go beyond the accomplishment of the intended benefits. Specifically impediments can be attributed to data privacy issues, data security issues, weak or uncoordinated data policies, weak or uncoordinated data governance, and conflicting market forces, costs, interoperability and integration issues, acceptance of IoT, and trust related issues, a lack of sufficient knowledge regarding IoT, IT infrastructural limitations, and data management issues. It is clear that IoT will have a major impact on e-commerce services in the future and will bring a variety of benefits for e-commerce at all levels, but these needs to be carefully balanced with the risks and appropriate mitigation measures taken.

Many of the issues are interrelated; interoperability and integration issues have a direct impact on costs and on trust in the systems, and many issues can be resolved with sufficient knowledge and capabilities within the organization and the issues do need to be resolved in concert. It is important that organizations address dominant impediments, such as privacy and security issues, within policy and legal frameworks during the implementation of IoT. Similarly, technical and knowledge issues are very much interrelated with a lack of standards and impediments regarding interoperability and integration of data. Organizations should keep this dual perspective in mind when using and designing IoT applications.

The Fifteenth International Conference on Electronic Business, Hong Kong, December 6-10, 2015

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ACKNOWLEDGEMENTS
We acknowledge and thank the people of the Rijkswaterstaat who gave of their time and expertise during the case study research. This research is funded by Rijkswaterstaat.

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The Fifteenth International Conference on Electronic Business, Hong Kong, December 6–10, 2015


EFFECT OF USING HUMAN IMAGES IN PRODUCT PRESENTATION OF E-COMMERCE WEBSITE ON TRUST, FIXATION AND PURCHASE INTENTION

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ABSTRACT

The objective of this study is to conduct an investigation on the five conditions of product presentations which are (1) a female presenter with positive facial expression, (2) a female presenter without facial expression, (3) a male presenter with positive facial expression, (4) a male presenter without facial expression, and (5) product presentation without a presenter. The factors of interest include (1) trust, (2) fixation, (3) purchase intention, and also (4) gender of buyers. This study uses data collected from experiments conducted in Chulalongkorn Business School research unit. The instruments used in the experiments include (1) five websites of a hotel with five different conditions of product presentation, (2) questionnaires to collect trust and purchase intention, and (3) Mirametrix S2 Eye Tracker to collect fixation duration. Analysis results from data collected from 150 samples indicate that there is a significant effect of using human presenter toward trust, especially when respondents are females. However, there are no significant differences of purchase intention and no significant differences of fixation duration for each of the five conditions of product presentation.

Keywords: Human Image, Product Presentation, Fixation, Trust, Purchase Intention

INTRODUCTION

Electronic commerce industry has been continuously growing. However, the electronic commerce users or consumers are still concerning about the quality of information displayed on websites. Besides, an online shopping is not conducted by actual salespersons that provide recommendations or answer questions to customers. Product information on websites which internet vendors use for communication with buyers is mostly in text and image format [7]. Buyers usually consider this information carefully before making purchase decisions [1] [5] [13], particularly for purchase decisions in service businesses. The most important factor of service business is communication which provides information to support customer decision process. The survey results by Electronic Transaction Development Agency (ETDA), Thailand (2014) [3], indicate that 46.9% of Thai people use Internet for buying and selling product/service. 37.3% of them use Internet to reserve or buy online tickets. Moreover, Thai people still prefer conducting online transactions via web applications over mobile applications.

To create the electronic commerce environment that will make buyers feel like they are shopping in real physical shops, Riegelsberger et al. [9] [10] have suggested that representatives or something which performs some kinds of socialization should be inserted in the website design. Examples of these socialization features include additional chat box, photos, videos, messages or speech. This concept about socialization is consistent with research by Steinbruck et al. [14] which confirmed that the insertion of representatives or social signs would increase customer’s reliance. Especially, when customers see human photos, they will feel warmth, and this concept creates atmosphere similarly to face-to-face human interaction. Usually, website owners chose human images with positive facial expression to induce good attitude of customers toward their products, because these images create a warm and friendly environment. Furthermore, positive attitude toward online environment can lead to trust between sellers and buyers, and finally, lead to purchase intention and real online purchase behaviors [11]. Also, Nielsen and Pernice [8] suggested that image selection for websites should be applied by considering consistency of images and website content. Aside from the issue of unreliable information on websites, Schenkm an and Jonsson [12] reported that buyers quit from webpages because of uninteresting content of those webpages. Cyr et al. [2] found in their research that when human images were used, the samples felt more attracted to the websites. Conversely, website without human image led to unattractive feeling toward website contents.

In our research, hotel business was selected because Thai people prefer using website to reserve hotel rooms. So, the study was conducted using human images of hotel presentation on electronic commerce website in five conditions; (1) a female presenter with positive facial expression, (2) a female presenter without facial expression, (3) a male presenter with positive facial expression, (4) a male presenter without facial expression, and (5) hotel presentation without a presenter, which affect (1) trust, (2) fixation, and (3) purchase intention. Moreover, another moderator variable used is gender of buyers because different genders may lead to differences perception of each of the five website conditions, and purchase intention.

RESEARCH OBJECTIVES

This research has three main objectives as follow:

1. To study effect of using human images in product presentation on electronic commerce website on (1) trust, (2) fixation and (3) purchase intention. The five conditions of website are (1) a female presenter with positive facial expression, (2) a female...
presenter without facial expression, (3) a male presenter with positive facial expression, (4) a male presenter without facial expression, and (5) product presentation without a presenter.

2. To study effect of using human images in product presentation on electronic commerce website on (1) trust, (2) fixation and (3) purchase intention when buyers are males or females.

3. To study relationships between trust and purchase intention, as well as fixation duration and purchase intention.

RESEARCH MODEL AND HYPOTHESIS

Research Model

Hypothesis
H1: Using human images in product presentation on the website will have effect on trust.
H2: Using human images in product presentation on the website will have effect on trust, when buyers’ gender is male.
H3: Using human images in product presentation on the website will have effect on trust, when buyers’ gender is female.
H4: Using human images in product presentation on the website will have effect on fixation duration.
H5: Using human images in product presentation on the website will have effect on fixation duration, when buyers’ gender is male.
H6: Using human images in product presentation on the website will have effect on fixation duration, when buyers’ gender is female.
H7: Using human images in product presentation on the website will have effect on purchase intention.
H8: Using human images in product presentation on the website will have effect on purchase intention, when buyers’ gender is male.
H9: Using human images in product presentation on the website will have effect on purchase intention, when buyers’ gender is female.
H10: There is relationship between fixation duration and purchase intention.
H11: There is relationship between Trust and purchase intention.

RESEARCH METHODOLOGY

Research Instrument Development
There are three research tools in this research.

1. Five new websites were developed to be used in this experiment. These websites are hotel booking service. The five conditions of using human presenter in hotel booking website as mentioned earlier are presented in Table 1.
In order to develop five suitable websites for this study, we conducted a preliminary study. There were 108 samples, 39 males and 69 females, participated in our preliminary study. We used the results of the preliminary study to adjust our original websites to make sure that users will really perceive the right facial expression of each websites. The adjusted websites are presented in Figure 2 – Figure 6.

1. Website A – a female presenter with positive facial expression
2. Website B – a female presenter with neutral expression
3. Website C – a male presenter with positive facial expression
4. Website D – a male presenter with neutral expression
5. Website E – product presentation without a presenter

<table>
<thead>
<tr>
<th>Website Condition</th>
<th>Using Human Images in Product Presentation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>a presenter with positive facial expression</td>
</tr>
<tr>
<td></td>
<td>Female</td>
</tr>
<tr>
<td>A</td>
<td>●</td>
</tr>
<tr>
<td>B</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td></td>
</tr>
<tr>
<td>E</td>
<td></td>
</tr>
</tbody>
</table>

Figure 2 – Website A
A self-report questionnaire was used as fundamental data collection tool. The questionnaire is divided into 3 sections. As shown in Table 2.

Section 1: Questions about respondent’s general information such as gender and experiences of purchasing product via the Internet.

Section 2: Questions for respondents to evaluate their trust which were modified from the study by Kobayashi and Okada [6] on website trust, as presented in Table 2.

Section 3: Questions for respondents to evaluate their purchase intention which were modified from the study by Torchareon [15], as presented in Table 2.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Dimension</th>
<th>Items</th>
<th>Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>Website</td>
<td>TRUST</td>
<td>T-01</td>
<td>You think that the website, <a href="http://www.AndamanSweetHotel.com">www.AndamanSweetHotel.com</a> will not disclose</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>your personal information to others without your permission.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>T-02</td>
<td>You think that the website, <a href="http://www.AndamanSweetHotel.com">www.AndamanSweetHotel.com</a>, provide sufficient</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>information as you expect</td>
</tr>
<tr>
<td></td>
<td></td>
<td>T-03</td>
<td>You think that the website, <a href="http://www.AndamanSweetHotel.com">www.AndamanSweetHotel.com</a>, provide all</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>information necessary for hotel booking.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>T-04</td>
<td>Overall, you think that the website, <a href="http://www.AndamanSweetHotel.com">www.AndamanSweetHotel.com</a>, is</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>reliable and trustworthy.</td>
</tr>
<tr>
<td></td>
<td>Hotel</td>
<td>T-05</td>
<td>You think that Andaman Sweet Hotel can provide services as their</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>advertised commitments.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>T-06</td>
<td>You think that Andaman Sweet Hotel can provide services in line with</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>your requirements.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>T-07</td>
<td>You are confident that Andaman Sweet Hotel is reliable, trustworthy, and</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>sincere to provide services.</td>
</tr>
<tr>
<td></td>
<td>INTENTION</td>
<td>PI-02</td>
<td>If you want to book a hotel room in Phuket, you tend to choose a room</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PI-03</td>
<td>You tend to recommend the website, <a href="http://www.AndamanSweetHotel.com">www.AndamanSweetHotel.com</a>, to your</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>friends or acquaintance.</td>
</tr>
</tbody>
</table>
3. The eye tracking device was employed to measure fixation duration by collecting the eye-gaze data of each respondent in the specific area or area of interest (AOI). As shown is figure 7. We tracked user eye movements on the webpages during the experiment. We used the eye tracking data to calculate fixation duration on the main images of home page in the study. We used fixation duration because it is one of the reliable indicators to measure user’s attention.

![Figure 7 – Area of interest (AOI) on website](image)

**Measurement**

Measurement for trust was modified from [6] and those for purchase intention modified from [15] using a five-point Likert scale with “1 = strongly disagree” to “5 = strongly agree”. Cronbach’s Alpha was used to assess the reliabilities of the research variables. The Cronbach’s alpha values for the measures were 0.829 and 0.913 for trust and purchase intention consecutively, as shown in Table 3.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Dimension</th>
<th>Items</th>
<th>Mean</th>
<th>S.D.</th>
<th>Cronbach’s Alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>TRUST</td>
<td>Website</td>
<td>T-01</td>
<td>3.513</td>
<td>0.817</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>T-02</td>
<td>3.580</td>
<td>0.805</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>T-03</td>
<td>3.707</td>
<td>0.863</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>T-04</td>
<td>3.607</td>
<td>0.793</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hotel</td>
<td>T-05</td>
<td>3.647</td>
<td>0.795</td>
<td>0.829</td>
</tr>
<tr>
<td></td>
<td></td>
<td>T-06</td>
<td>3.620</td>
<td>0.662</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>T-07</td>
<td>3.587</td>
<td>0.753</td>
<td></td>
</tr>
<tr>
<td>PURCHASE INTENTION</td>
<td>Website</td>
<td>PI-01</td>
<td>3.013</td>
<td>0.927</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>PI-02</td>
<td>3.047</td>
<td>0.985</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>PI-03</td>
<td>2.893</td>
<td>0.991</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hotel</td>
<td>PI-04</td>
<td>3.173</td>
<td>0.961</td>
<td>0.913</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PI-05</td>
<td>3.353</td>
<td>0.906</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>PI-06</td>
<td>3.080</td>
<td>0.973</td>
<td></td>
</tr>
</tbody>
</table>
DATA ANALYSIS AND HYPOTHESIS TESTING RESULTS

Data Collection
From the statistical survey of Internet usage in Thailand by Electronic Transaction Development Agency (ETDA) [3] [4], we found that Thai people who buy from Internet are people in their 20-35 years old. So, Thai people in their 20-35 years old are our population for this study. The samples which we select for the experiment are bachelor or master degree students from Chulalongkorn Business School, Chulalongkorn University, Thailand. They are Internet users and in their 20-35 years old. We divide samples into 10 groups (5 website conditions x 2 buyer genders).

Descriptive Statistics
The data were collected from 150 respondents who are Internet users and in their 20-35 years old, as mentioned earlier. Most of respondents have internet experience 5-7 years. Especially, 88% of them have online shopping experiences. A summary of demographic information of those 150 respondents is shown in Table 4.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>62</td>
<td>41.3</td>
</tr>
<tr>
<td>Female</td>
<td>88</td>
<td>58.7</td>
</tr>
<tr>
<td>Internet Usage Experience</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 3 years</td>
<td>6</td>
<td>4.0</td>
</tr>
<tr>
<td>3 - 5 years</td>
<td>15</td>
<td>10.0</td>
</tr>
<tr>
<td>5 - 7 years</td>
<td>67</td>
<td>44.7</td>
</tr>
<tr>
<td>More than 7 years</td>
<td>62</td>
<td>41.3</td>
</tr>
<tr>
<td>times purchase</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never</td>
<td>18</td>
<td>12.0</td>
</tr>
<tr>
<td>1 - 5 times</td>
<td>84</td>
<td>560</td>
</tr>
<tr>
<td>6 - 10 times</td>
<td>25</td>
<td>16.7</td>
</tr>
<tr>
<td>More than 10 times</td>
<td>23</td>
<td>15.3</td>
</tr>
<tr>
<td>Service</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never</td>
<td>18</td>
<td>5.1</td>
</tr>
<tr>
<td>Booking flight</td>
<td>82</td>
<td>23.2</td>
</tr>
<tr>
<td>Booking hotel room</td>
<td>62</td>
<td>17.5</td>
</tr>
<tr>
<td>Internet banking</td>
<td>56</td>
<td>15.8</td>
</tr>
<tr>
<td>Internet streaming media</td>
<td>26</td>
<td>7.3</td>
</tr>
<tr>
<td>(such as, iflix, HollywoodHD, PrimeTime)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Booking movie tickets</td>
<td>55</td>
<td>15.5</td>
</tr>
<tr>
<td>Food delivery</td>
<td>48</td>
<td>13.6</td>
</tr>
<tr>
<td>Other</td>
<td>7</td>
<td>2.0</td>
</tr>
</tbody>
</table>

Table – 4 Summary of respondents’ demographic

Hypotheses Testing
Result of using of human pictures to present products on the website towards trust.

<table>
<thead>
<tr>
<th>Conditions of using human presenter in hotel booking website</th>
<th>Mean Score</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A female presenter with positive facial expression</td>
<td>3.42</td>
<td></td>
</tr>
<tr>
<td>A female presenter with neutral facial expression</td>
<td>3.46</td>
<td></td>
</tr>
<tr>
<td>A male presenter with positive facial expression</td>
<td>3.74</td>
<td>0.03</td>
</tr>
<tr>
<td>A male presenter with neutral facial expression</td>
<td>3.73</td>
<td></td>
</tr>
<tr>
<td>Product presentation without a presenter</td>
<td>3.73</td>
<td></td>
</tr>
</tbody>
</table>

Anova test result, as shown in Table 5, indicates that using different human presenters in hotel booking website associates with significantly different trust, at the significance level of 0.05.
Result of using of human pictures to present products on the website towards trust, when respondents' genders are different

### Table – 6 Mean score value of trust for each product presentation conditions, and Anova test result, with buyer’s gender

<table>
<thead>
<tr>
<th>Conditions of using human presenter in hotel booking website</th>
<th>Male buyers</th>
<th>Female buyers</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A female presenter with positive facial expression</td>
<td>3.60</td>
<td>3.26</td>
<td></td>
</tr>
<tr>
<td>A female presenter with neutral facial expression</td>
<td>3.44</td>
<td>3.48</td>
<td></td>
</tr>
<tr>
<td>A male presenter with positive facial expression</td>
<td>3.78</td>
<td>3.71</td>
<td></td>
</tr>
<tr>
<td>A male presenter with neutral facial expression</td>
<td>3.62</td>
<td>3.78</td>
<td></td>
</tr>
<tr>
<td>Product presentation without a presenter</td>
<td>3.81</td>
<td>3.66</td>
<td>0.36</td>
</tr>
</tbody>
</table>

Anova test results, as shown in Table 6, indicate that using different human presenters in hotel booking website associates with significantly different trust, at the significance level of 0.05, when buyers are female. However, the same association is not true when buyers are male.

Result of using of human pictures to present products on the website towards purchase intention.

### Table – 7 Mean score value of purchase intention for each product presentation conditions, and Anova test result

<table>
<thead>
<tr>
<th>Conditions of using human presenter in hotel booking website</th>
<th>Mean Score</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A female presenter with positive facial expression</td>
<td>3.04</td>
<td></td>
</tr>
<tr>
<td>A female presenter with neutral facial expression</td>
<td>3.02</td>
<td>0.94</td>
</tr>
<tr>
<td>A male presenter with positive facial expression</td>
<td>3.12</td>
<td></td>
</tr>
<tr>
<td>A male presenter with neutral facial expression</td>
<td>3.16</td>
<td></td>
</tr>
<tr>
<td>Product presentation without a presenter</td>
<td>3.14</td>
<td></td>
</tr>
</tbody>
</table>

Anova test result, as shown in Table 7, indicates that there is no significant difference of purchase intention between five conditions of product presentation, at the significance level of 0.05.

Result of using of human pictures to present products on the website towards purchase intention, when respondents’ genders are different

### Table – 8 Mean score value of purchase intention for each product presentation conditions, and Anova test result, with buyer’s gender

<table>
<thead>
<tr>
<th>Conditions of using human presenter in hotel booking website</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>A female presenter with positive facial expression</td>
<td>3.23</td>
<td>2.88</td>
</tr>
<tr>
<td>A female presenter with neutral facial expression</td>
<td>2.98</td>
<td>3.05</td>
</tr>
<tr>
<td>A male presenter with positive facial expression</td>
<td>2.93</td>
<td>3.23</td>
</tr>
<tr>
<td>A male presenter with neutral facial expression</td>
<td>2.85</td>
<td>3.33</td>
</tr>
<tr>
<td>Product presentation without a presenter</td>
<td>3.37</td>
<td>2.94</td>
</tr>
</tbody>
</table>

| Sig. | 0.51 | 0.36 |

Anova test result, as shown in Table 8, indicates that there is no significant difference of purchase intention between five conditions of product presentation, at the significance level of 0.05, for both male and female buyers.
Result of using of human pictures to present products on the website towards fixation duration.

Table – 9 Kruskal-Wallis H Test Sig. value of fixation duration

<table>
<thead>
<tr>
<th>Fixation Duration</th>
<th>Chi-Square</th>
<th>df</th>
<th>Asymp. Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3.574</td>
<td>4</td>
<td>0.467</td>
</tr>
</tbody>
</table>

Table – 10 Mean rank value of fixation duration for each product presentation conditions with Kruskal-Wallis H Test

<table>
<thead>
<tr>
<th>Conditions of using human presenter in hotel booking website</th>
<th>Mean Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>A female presenter with positive facial expression</td>
<td>80.50</td>
</tr>
<tr>
<td>A female presenter with neutral facial expression</td>
<td>82.41</td>
</tr>
<tr>
<td>A male presenter with positive facial expression</td>
<td>78.34</td>
</tr>
<tr>
<td>A male presenter with neutral facial expression</td>
<td>72.22</td>
</tr>
<tr>
<td>Product presentation without a presenter</td>
<td>64.10</td>
</tr>
</tbody>
</table>

Form Table 9 and Table 10, we can conclude that there is no significant difference of fixation duration between five conditions of product presentation, at the significance level of 0.05.

Table – 11 Number of samples, mean score value, Std. deviation, minimum and maximum of fixation duration

<table>
<thead>
<tr>
<th>Conditions of using human presenter in hotel booking website</th>
<th>N</th>
<th>Mean</th>
<th>S.D.</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>A female presenter with positive facial expression</td>
<td>31</td>
<td>7.25</td>
<td>4.72</td>
<td>1.97</td>
<td>21.57</td>
</tr>
<tr>
<td>A female presenter with neutral facial expression</td>
<td>32</td>
<td>7.26</td>
<td>4.19</td>
<td>1.70</td>
<td>20.80</td>
</tr>
<tr>
<td>A male presenter with positive facial expression</td>
<td>25</td>
<td>6.77</td>
<td>3.95</td>
<td>2.02</td>
<td>14.90</td>
</tr>
<tr>
<td>A male presenter with neutral facial expression</td>
<td>32</td>
<td>6.70</td>
<td>5.25</td>
<td>0.34</td>
<td>21.03</td>
</tr>
<tr>
<td>Product presentation without a presenter</td>
<td>30</td>
<td>5.50</td>
<td>3.63</td>
<td>0.78</td>
<td>13.24</td>
</tr>
<tr>
<td>Total</td>
<td>150</td>
<td>6.70</td>
<td>4.40</td>
<td>0.34</td>
<td>21.57</td>
</tr>
</tbody>
</table>

Result of using of human pictures to present products on the website towards fixation duration, when respondents’ genders are different.

Table – 12 Kruskal-Wallis H Test Sig. value of fixation duration

<table>
<thead>
<tr>
<th></th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chi-Square</td>
<td>5.741</td>
<td>1.956</td>
</tr>
<tr>
<td>df</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Asymp. Sig.</td>
<td>0.219</td>
<td>0.744</td>
</tr>
</tbody>
</table>
Form Table 12 and Table 13, we can conclude that there is no significant difference of fixation duration between five conditions of product presentation, at the significance level of 0.05, for both male and female buyers.

From Table 14, we found that when respondents were males, using a male presenter with neutral facial expression in product presentation gave the longest fixation duration (8.45 second). Moreover, for respondents were females, using a male presenter with positive facial expression in product presentation gave the longest fixation duration (7.41 second).

**Result Correlation between trust and purchase intention**

Table – 15 Correlation analysis between trust and purchase intention

<table>
<thead>
<tr>
<th></th>
<th>Trust</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson Correlation</td>
<td>.551**</td>
</tr>
<tr>
<td>Purchase Intention</td>
<td>Sig. (2-tailed) .000</td>
</tr>
<tr>
<td>N</td>
<td>150</td>
</tr>
</tbody>
</table>

The result of correlation analysis, displayed in Table 15, indicates significant positive correlations between trust and purchase intention.

**Result Correlation between fixation and purchase intention**

Table – 16 Correlation analysis between fixation duration and purchase intention

<table>
<thead>
<tr>
<th></th>
<th>Fixation duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson Correlation</td>
<td>-.145</td>
</tr>
<tr>
<td>Purchase Intention</td>
<td>Sig. (2-tailed) .078</td>
</tr>
<tr>
<td>N</td>
<td>150</td>
</tr>
</tbody>
</table>

The result of correlation analysis, displayed in Table 16, indicates no significant correlations between fixation duration and purchase intention.
CONCLUSION
Using human in product presentation of e-commerce website depends on many factors, in this study, we consider five factors such as facial expression, genders of the presenter, buyer’s fixation, trust, and purchase intention. The study results indicate significant effect of using human presenter toward trust, especially when respondents are females. However, there are no significant differences of purchase intention and no significant differences of fixation duration for each of the five conditions of product presentation.

However, we found that a male presenter with neutral facial expression in product presentation was more attractive to male respondents, and a male presenter with positive facial expression in product presentation was more attractive to female respondents. Results of this study can be used as a guideline for hotel website owners to choose a suitable human image in product presentation of e-commerce website for their website.

ACKNOWLEDGMENTS
The authors would like to acknowledge the Chulalongkorn Academic Advancement into Its 2nd Century Project for financial support and the Business Visualization Research Group, Chulalongkorn Business School, Chulalongkorn University for supporting of Mirametrix S2 Eye-tracker used in this study.
REFERENCES


ELECTRONIC TOURISM QUALITY FOR ENHANCING TOURIST RELATIONSHIP

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Wanchai Khanti, Thammasat Business School, Thailand, wanchai@tbs.tu.ac.th

ABSTRACT

The objectives of this paper are to identify the components of the E-tourism quality and to determine E-tourism quality factors that have impact on enhancing tourist relationship. Data was collected from Thai and foreign tourists. Exploratory factor analysis was conducted to determine the components for E-tourism quality. The results show that the two major components of E-tourism quality are E-service quality and E-marketing management quality. E-tourism service quality consists of four dimensions which are 1) website design quality, 2) E-service design quality, 3) technology quality and 4) customer service quality. E-marketing management, E-service design, technology quality and customer service quality have impact on tourist relationship. E-marketing management quality has the highest influence on enhancing tourist relationship whereas website design quality has no impact.

Keywords: E-tourism quality, E-tourism Service Quality, E-tourism Marketing Management Quality, Relationship

INTRODUCTION

In the tourism industry, many organizations have developed websites and web applications to provide information, communicate, and make service transactions for their customers. The internet creates value through allowing tourists to access information and use services anytime and anywhere. The internet offers opportunities to enhance revenue and reduce costs for many stakeholders. In addition, the internet allows businesses to redesign their business processes and bring service to customers more efficiently.

In 2009, the Thai government initiated a policy to increase revenue from the tourism sector. The Department of Tourism was established with the mission to improve the quality of the Thai tourism industry which led to the development of electronic tourism (E-tourism) management in Thailand meant to increase business opportunities and revenues. However, the quality of traditional tourism services differs greatly from electronic services via the internet. There are very few studies on online service quality offering conclusive guidance on the quality of electronic services in an e-tourism context [30][19]. Moreover, providing service quality that is value-adding for customers can enhance relationships. Relationship is created when valuable services are designed into the service system to help clients to operate more efficiently, such as technical support assistance, or use of software provided by the service provider. This relationship can raise the clients’ costs to switch to other competitors, is the most difficult for competitors to imitate [2][3].

This study aims to explore the components of service quality in E-tourism from the perspective of foreign and Thai tourists and to assess E-tourism quality components that have impact on building tourist relationship.

LITERATURE REVIEW

Customer Relationship

Relationship marketing has been conceptualized in different ways among academic researchers. For instance, Grönroos [5] defined relationship marketing as “marketing to establish, maintain, enhance and commercialize customer relationships so as the objectives of the parties are met. Gummesson [10] defined a marketing relationship as relationships, network and interaction. He pointed out that the strength of the relationship can be enhanced through internal measures or from outside the organization. In other words, relationship marketing provides an approach that helps businesses to establish relationships with customers and other parties involved in the business process.

E-Service Quality

Traditionally, the SERVQUAL model [18] is used to assess customer perception of service quality from service providers. It consists of reliability, responsiveness, competence, access, courtesy, communication, credibility, security, understanding customers, and tangible. Grönroos [9] proposed a functional quality and a technical quality to evaluate service quality. However, the service quality perceived by customers through direct personal interaction with a service provider differs from service quality perception when interacting with online services via the internet. Attributes such as the quality of the website used as the channel of service will impact a customer’s perception of quality. Electronic service quality, as measured by the ES-QUAL model [19], eTailQ model [30], SITEQUAL model [32], WebQual model [14], and e-SQ model [33], have modified the service quality model to suit the environment of electronic service quality. For instance, electronic service quality includes website and information quality, aesthetic design, immediate response, security and privacy [1] [5][12][13] [21][28][31][33]. Rotchanakitumnuai [22] proposed that electronic service quality should emphasize the quality of service design, customer support, web design, and technology support. In this study, service quality will cover all services related to the E-tourism industry including website quality, customer service quality, and the quality of information technology that supports the electronic services [24].

The quality of website design relates to how an E-tourism website provides relevant and timely data in an easily updatable

The Fifteenth International Conference on Electronic Business, Hong Kong, December 6-10, 2015

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manner, and provides easily understood information [4] [8] [25]. Electronic service design quality must ensure user-friendly processes [32] and be attractive to customers [25]. Customer service quality is related to customer support before, during, and after the service [19] [28]. In order to build trust with users, the quality of technology support requires that electronic services system must be secure with guaranteed privacy [8] [23]. Customer relationship is enhanced when quality services are designed into the service system to assist customers to operate more efficiently (e.g. technical support assistance, electronic service) [2] [3].

Therefore, the hypotheses for the study are:

H1: The higher tourists perceived website design quality, the higher customer relationship creation.
H2: The higher tourists perceived electronic service design quality, the higher customer relationship creation.
H3: The higher tourists perceived technology quality, the higher customer relationship creation.
H4: The higher tourists perceived customer support quality, the higher customer relationship creation.

In addition, electronic marketing management is a major factor that can enhance customer relationships [26] [27]. Pricing as the key factor for customer satisfaction [6] [11] [15] [16]. Moreover, promotion, advertising, the branding of websites, and integration of communication channels all build a relationship with customers [4] [7] [10] [17] [20] [29]. The last hypothesis is:

H5: The higher tourists perceived E-marketing management quality, the higher customer relationship creation.

**METHODOLOGY**

This research employed a questionnaire to measure the perception of Thai and International tourists on E-Tourism service quality. Judgment sampling was applied to select and interview the targeted respondents who use tourism websites to search for travel information. Respondent characteristics are described in Table 1.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Thai Tourists</th>
<th>International Tourists</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>153</td>
<td>56.9</td>
<td>199</td>
</tr>
<tr>
<td>Male</td>
<td>115</td>
<td>42.8</td>
<td>287</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Below 30</td>
<td>87</td>
<td>32.3</td>
<td>191</td>
</tr>
<tr>
<td>30 – 40</td>
<td>139</td>
<td>51.7</td>
<td>208</td>
</tr>
<tr>
<td>Above 40-50</td>
<td>32</td>
<td>11.9</td>
<td>60</td>
</tr>
<tr>
<td>Above 50-60</td>
<td>8</td>
<td>3.0</td>
<td>26</td>
</tr>
<tr>
<td>Above 60</td>
<td>3</td>
<td>1.1</td>
<td>1</td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Below Bachelor</td>
<td>4</td>
<td>1.5</td>
<td>35</td>
</tr>
<tr>
<td>Bachelor</td>
<td>151</td>
<td>56.1</td>
<td>382</td>
</tr>
<tr>
<td>Master</td>
<td>103</td>
<td>38.3</td>
<td>43</td>
</tr>
<tr>
<td>PhD</td>
<td>8</td>
<td>3.0</td>
<td>4</td>
</tr>
</tbody>
</table>

**DATA ANALYSIS**

Table 2 shows two E-tourism quality components. The first component is E-tourism service quality. The second component is E-marketing management quality. E-tourism service quality consists of four factors: website design quality, service design quality, technology quality, and customer support quality. All constructs of E-tourism quality components have high levels of reliability with Cronbach’s Alpha values ranging from 0.632 - 0.785, indicating good reliability. For E-tourism website design quality, overall the tourists ranked up-to-date information (4.46) and easy to understand information (4.37) with high mean scores. Service design quality that is simple to use and make transactions has a high mean score (4.25). Security (4.19) and privacy policy protection (4.14) are the two most important issues of technology quality.

Respondents rated E-marketing management items with mean scores from 4.05-4.10. A wide variety of products/services offering scored highest (4.10), Followed by lower price policy for transactions via website (4.06), and promotions via digital channels (4.05).

Multiple regression analysis was performed to determine the impact of E-tourism quality on customer relationship. Factor scores on each factor for each respondent served as input to further regression analysis. The results are summarized in Table 3. The overall regression model was significant with 38 percent of the variance in strength of customer relationship explained by these independent variables, as indicated by the $R^2$. E-marketing management, E-service design, technology quality and customer service quality have impact on tourist relationship. E-marketing management quality has the highest influence on enhancing tourist relationship whereas website design quality has no impact.
### Table 2. Factor Analysis

<table>
<thead>
<tr>
<th>Factor / Item</th>
<th>Factor Loading</th>
<th>Mean</th>
<th>S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1 E-tourism Service Quality</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1 Website Design Quality (Cronbach’s Alpha = .695)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The website provides easy to understand tourism information</td>
<td>.792</td>
<td>4.37</td>
<td>.672</td>
</tr>
<tr>
<td>The website provides up-to-date tourism information</td>
<td>.806</td>
<td>4.46</td>
<td>.651</td>
</tr>
<tr>
<td>The website provides complete tourism information</td>
<td>.742</td>
<td>4.26</td>
<td>.656</td>
</tr>
<tr>
<td>The website provides multiple languages of tourism information</td>
<td>.540</td>
<td>3.99</td>
<td>.815</td>
</tr>
<tr>
<td>1.2 Service Design Quality (Cronbach’s Alpha = .632)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The website is designed as simple to use and make transactions.</td>
<td>.782</td>
<td>4.25</td>
<td>.712</td>
</tr>
<tr>
<td>The website is aesthetic.</td>
<td>.752</td>
<td>4.01</td>
<td>.700</td>
</tr>
<tr>
<td>The website is designed for easy searching to get related information.</td>
<td>.742</td>
<td>4.20</td>
<td>.723</td>
</tr>
<tr>
<td><strong>1.3 Technology Quality (Cronbach’s Alpha = .708)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The website provides good security technology.</td>
<td>.745</td>
<td>4.14</td>
<td>.807</td>
</tr>
<tr>
<td>The website supports a large volume of transactions.</td>
<td>.662</td>
<td>3.99</td>
<td>.776</td>
</tr>
<tr>
<td>The website loads quickly.</td>
<td>.754</td>
<td>4.19</td>
<td>.796</td>
</tr>
<tr>
<td>The website upholds its privacy policy.</td>
<td>.759</td>
<td>4.13</td>
<td>.823</td>
</tr>
<tr>
<td><strong>1.4 Customer Support Quality (Cronbach’s Alpha = .688)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The website provides an immediate response to customers after transactions finish.</td>
<td>.785</td>
<td>4.09</td>
<td>.788</td>
</tr>
<tr>
<td>The website provides 24/7 customer service.</td>
<td>.845</td>
<td>4.02</td>
<td>.841</td>
</tr>
<tr>
<td>The website provides social networks to communicate and share information with customers/between customers.</td>
<td>.722</td>
<td>3.96</td>
<td>.812</td>
</tr>
<tr>
<td><strong>2 E-marketing Management Quality (Cronbach’s Alpha = .785)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The service provider has a lower price policy for transaction via website.</td>
<td>.597</td>
<td>4.05</td>
<td>.768</td>
</tr>
<tr>
<td>The service provider uses digital channels for promotion/PR (e.g., website / social network).</td>
<td>.794</td>
<td>4.08</td>
<td>.692</td>
</tr>
<tr>
<td>The service provider uses digital channels to communicate with travelers / customers (e.g., website/social network).</td>
<td>.797</td>
<td>4.07</td>
<td>.703</td>
</tr>
<tr>
<td>The service provider offers a variety of tourism products/services for target customers.</td>
<td>.746</td>
<td>4.10</td>
<td>.700</td>
</tr>
<tr>
<td>The service provider offers customized tourism programs for individuals.</td>
<td>.726</td>
<td>4.08</td>
<td>.736</td>
</tr>
</tbody>
</table>

### Table 3: Impact of E-Tourism Quality on Customer Relationship

<table>
<thead>
<tr>
<th>Factor</th>
<th>β</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>1.307</td>
<td>.000</td>
</tr>
<tr>
<td>Website Design Quality</td>
<td>.014</td>
<td>.750</td>
</tr>
<tr>
<td>Service Design Quality</td>
<td>.127</td>
<td>.000</td>
</tr>
<tr>
<td>Technology Quality</td>
<td>.139</td>
<td>.000</td>
</tr>
<tr>
<td>Customer Support Quality</td>
<td>.063</td>
<td>.035</td>
</tr>
<tr>
<td>E-Marketing Management Quality</td>
<td>.373</td>
<td>.000</td>
</tr>
</tbody>
</table>

R² = .381

**CONCLUSIONS AND IMPLICATIONS**

In conclusion, E-tourism quality consists of two components: E-tourism service quality and E-marketing management quality. Website design quality, E-service design quality, technology quality, and customer support quality are the four dimensions of E-tourism service quality. A tourism website must be designed to provide easy-to-understand tourism information, provided that it...
is up-to-date, complete, and supporting multiple languages. Tourists gave highest importance to the items of website design quality providing up-to-date and easily understood tourism information.

E-tourism service providers must concern themselves with service design quality in terms of ease-of-use and conducting transactions, information search functions, and aesthetics. Management and investment in E-tourism technology must provide more efficient services. Tourists prefer to interact with a fast loading website that is secure and provides protection of privacy for customer information. The findings also indicate that respondents have high degree of interest in online customer support. Respondents also indicated that an immediate response to customer transactions is of great importance in determining the quality of a provider.

E-marketing management is also necessary to ensure the quality of E-tourism. For instance, using a lower price policy is a major incentive for tourists to conduct their transactions online. E-tourism service providers can use digital channels to promote and communicate to stakeholders. Moreover, travel services can be easily customized to a specific group of customers.

E-marketing management has the highest impact on enhancing tourist relationship. E-service design, technology quality and customer service quality also have impact on tourist relationship whereas website design quality has no impact.

This study can serve as a basis for evaluating E-tourism quality for the improvement of the E-tourism development in Thailand. Firstly, the results show that E-tourism service quality is critical to the achievement of four factors: website design, service design, technology, and customer support. Secondly, E-marketing management requires greater focus as this factor can enhance the relationship between tourists and E-tourism service providers. Future research should consider the readiness of E-tourism service providers to investigate the impact of these components on actual performance.

REFERENCES

ENHANCING ENGAGEMENT IN VIRTUAL COMMUNITIES
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Albert Huang, University of the Pacific, USA, ahuang@pacific.edu

Abstract
Virtual communities have been growing in the last two decades and have become an important business tool for various purposes. This paper studied the relationships among three constructs—conflict, dissonance, and engagement—in their interaction with one another in virtual communities. Using dissonance as a mediating variable, the relationship between conflict and engagement was analyzed using data collected from 327 virtual community members. The results suggest that conflict has a positive influence on both dissonance and engagement. Dissonance was also positively associated with engagement. To confirm the findings and to fully understand the effect of conflict, more research is needed. For operators of virtual communities and their associated businesses, the most significant implication is that the existence of conflict may heighten the level of engagement. This study is the first step in understanding the relationship between dissonance, perceived conflict, and engagement in the context of virtual communities.
ENGAGING TECHNOLOGIES-SAVVY CONSUMERS WITH THE INTERNET OF THINGS

John R. Hamilton, James Cook University, Cairns, Australia, John.Hamilton@jcu.edu.au
Singwhat Tee, James Cook University, Cairns, Australia, Singwhat.Tee@jcu.edu.au

ABSTRACT
Consumers today engage in and with interactive online activities. These activities are compiled from a vast array of online-hosted components loosely termed the Internet of Things (IoT). At the same time innovative corporates are delivering latest IoT-related and consumer-targeted smart solutions. This paper proposes the MVL model as a pathway to examine consumer value relationships, and to then map these relationships against relevant IoT-generated revenue streams. Hence, by capturing and tracking their IoT savvy consumer’s actions and activities, the corporate can gauge the success of their IoT offerings.

Keywords: Internet of things (IoT), value, customer, behavior, motivation, social, loyalty

INTRODUCTION
The internet continues to tap numerous consumer-tracking mechanisms and to extend business-reach mechanisms further towards real-time interactive consumer engagement [22][24]. Early studies considered the reasoned action of consumers [9] where technology acceptance [7] by consumers provided beliefs and motives, that in-turn, influenced attitude, then instilled intention, and then expanded behavior. Concept extensions by [7] linked consume-perceived-usefulness and a technology’s ease-of-use into attitude (to using), behavioral intention (to use) and actual system use. Other researchers considered marketing, technologies and/or design when mapping consumer actions across a website, and added ways to estimate effectiveness [4]. Tracking studies included site recognition, comprehension, connection, interactivity, value, quality, performance, and outcomes-focused studies in satisfaction, trust, loyalty, and revisit intention [5][33]. In general, these measurement inclusions have incrementally added to the position of web analytics [6] and to understanding web consumers [6][25].

LITERATURE REVIEW
Today consumers are diversifying and pursuing emerging ideas appearing across the ‘internet of things’ (IoT). The IoT offers virtual efficiencies, and connects multiple cloud systems [12]. The IoT also interlinks across mobile devices, measurement devices (such as gym monitors, thermometers, and apps), transporters, appliances, residences, workplaces, and it further interconnects with selected global databases. In this IoT age business can engage and offer powerful value creation tools that enable consumers to make astute decisions and this in-turn allows corporates to differentiate themselves from competitors [26].

The industrial IoT is a rich economic wealth generator where new innovations interlink consumers and business in unique economically-satisfying, social-engaging and emotionally-connecting ways [31]. The industrial IoT also expands its external wealth generators with technology-deployments extending and reaching consumers across the globe [2].


Accenture estimate the globally-interconnected industrial IOT can grow the gross domestic product of the top 20 developed and emerging national economies by $US14.2T [20]. Thus, the IoT is a productivity accelerator [30]. It is enabling new market-reach and overcoming infrastructure gaps by integrating technology breakthroughs [12] across its embedded unique innovations, and it is delivering radical new solutions [28]. These IoT deliverables are ‘collectively creating future industrial-game-changers for leading global economies’ [29].

Table 1 summarizes Accenture’s 2015 IoT list of industrial critical enabling frameworks [20]. Together, these are capable of assisting the build of differing suites of technologies, and along with targeted consumer-business connectivities into such innovative market sectors, these combined blue ocean investments can over-time deliver additional GDP growth [18].
Within this suite of IoT enabling framework lies the innovative dynamics ‘consumer-focused corporates’ - who value-target their consumers in real-time. This value servicing is beneficial to both the corporate – with automatic sensing, communicating and feedback, enhanced augmentation and lower labour-processing servicing costs, and the consumer with direct, convenient and more precise servicing [10]. To win transactions from consumers, and to build a new market for their innovative IoT product or service these corporates are very consumer-focused.

Hence, this paper proposes the research question: how can corporates meet the IoT savvy consumer expectations and value requirements? In considering this question we first segregate the IoT consumers and only consider those who are innovative adopters and link these with the corporates who innovate and bring these smart IoTs into their business solutions. To assess this relationship between innovative IoT corporates and their innovative adopters we develop a model that links consumers through their utilitarian and hedonic behaviours through social interactions and proposes a IoT values servicing system for such consumer-focused corporates.

**RESEARCH MODEL**

In the servicing domain, IoT consumers are in collective pursuit of differing degrees (and varieties) of servicing. They are moving from pursuing smart objects towards even smarter objects that can translate the awareness of causal relationships (or the knowledge of change and evolution over time) into actions [3].

Today isolated IoT objects are linking together and providing fragmented sections of heterogeneous smart-objects - where consumers choose to engage and also experience actual degrees of social consciousness [3]. An engaged IoT consumer actions (by sharing or sensing) a level of IoT-selected experiences across available social, mobile, analytical and cloud offerings. If suitably motivated the consumer actions the IoT at a level that acquires the intended stimulation patterns, and in so doing acquires some unintended stimulation patterning. Where this stimulation patterning can be measured an indirect IoT interaction pattern is determinable. Such measures in-turn may be socially and behaviourally differentiated[17]. Further, these social motivators can be linked into consumptive values and through to personal gratification levels [14]. Thus a behavioural approach to the IoT can elicit a measurement model by which corporates can identify who are their core consumers, and so can potentially track if its IoT-related offerings are changing over time [13][27] in line with consumer behaviors.

Hence we fit the consumer motivations for the corporate’s IoT offerings into four groupings. First, the consumers experience the corporate’s IoT offerings and related resources. The consumers discuss their IoT experiences as interlinked with the corporate’s integrated social and cloud offerings, and they discuss if their experiential and mobility demand pathways match their experiential demands. Second, the consumer holds a level of expected stimulation that is to be met by the corporate’s IoT offerings. This primary and intended motivator is a must deliver position by the corporate, and is the minimum consumer needs and wants expectation-set trigger to advance the consumer into a potential values engagement sequence. Third, to further convince the consumer their expectations are further stimulated with pattern enhancers. Here, the consumer’s corporate IoT expectations are enhanced and stimulated by desirable and fun patterning across functional, knowledge and design aspects. The consumer sees these as specifically enhancing their intended IoT business value solution. These motivating solutions in-turn draw the consumer towards engaging and transacting further with the corporate’s IoT offerings. Fourth, the consumer’s attitude to the corporate’s IoT offerings hinges on the consumer’s skills set being made (or assisted) sufficient to deliver them their desired experiences. This connectivity can motivate consumers and encourage them to engage further, and so help move the consumer towards the corporate’s strategic attempts to match the consumer’s projected consumptive value propositions.

**IoT Value Offerings**

The IoT is vast. Hence, the corporate selects and integrates only specific IoT items when mapping its deliverables towards its

---

**Table 1. Four critical enabling frameworks for industrial IoT [20]**

<table>
<thead>
<tr>
<th>Corporate Commonalities</th>
<th>Supporting infrastructures</th>
<th>Transference systems</th>
<th>Innovative Dynamics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communications infrastructure</td>
<td>Government support &amp; R&amp;D investment</td>
<td>Formal &amp; informal knowledge transfers</td>
<td>Entrepreneurial culture</td>
</tr>
<tr>
<td>Human capital</td>
<td>Science, technology, engineering, mathematics talent</td>
<td>Embracing new technologies within corporates</td>
<td>“Makerism” movement</td>
</tr>
<tr>
<td>Quality of governance &amp; research institutions</td>
<td>Quality of scientific research institutions</td>
<td>Consumer willingness to adopt new technologies</td>
<td>University - industry R&amp;D collaboration</td>
</tr>
<tr>
<td>Access to capital</td>
<td>Standards setting</td>
<td>Data privacy and security concerns</td>
<td>Technology development clustering</td>
</tr>
<tr>
<td>Economic openness</td>
<td>Urbanization</td>
<td></td>
<td>Consumer focused corporates</td>
</tr>
<tr>
<td></td>
<td>Expanding middle class</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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targeted consumers. From table 1 this study considers the ‘consumer-faced corporates’ sector. Here, the corporate IoT value offerings typically reside within Table 2’s five customer experienced value dimensions [11].

<table>
<thead>
<tr>
<th>Satisfiers Facilitation</th>
<th>Economic Reward</th>
<th>Servicing</th>
<th>Performance</th>
<th>Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Make consumers’ biz experiences easy, accessible and convenient Connect, transact, validate fast sensing data via mobiles and wearables Create fun, desirable, need and want environments for consumers</td>
<td>Presents rewards targeted at consumers Rewards for: time, money, effort, downloads and engagement(s) Incentives via promotions, or intrigue consumers into deeper engagement. Entertains via aesthetic or extended consumer life experiences</td>
<td>Offer new opportunities to past (retained) consumers Proactive servicing as convenient or augmented resolved responses Fast consumer-requested servicing responses Speed and accuracy of service-resolved responses to consumer Sales extension suggestions against the consumer’s past history Predictive recommendations and purchases</td>
<td>Track information trails and decision making of consumers Empowers consumers with the ability to act and to access intelligences Provide feedback Drives consumers via convenient closest location-based triggers (plus min number of steps to an output) Biz analytics &amp; path analysis align biz capabilities towards consumer actions and behaviors</td>
<td>Building customized personalized solutions Embedding new R&amp;D or improvements Capturing and incorporating feedback into biz solutions Sensing product and service movement of consumers</td>
</tr>
</tbody>
</table>

The corporate IoT value offerings typically reside within the following five value dimensions [13][21].
- satisfiers (or the consumer’s internal emotional feelings of value - typically meeting needs, wants, desires or contentment)
- economic values (or the consumer’s value requirements on a cost to personal-benefits scale – typically connecting with chosen others, receiving something for their time commitment, best price, features per item)
- servicing (or a values suite providing the customer’s chosen item(s) – in the fastest, point-to-point (precision), correct, and consumer-matched formats)
- performance (or a value measure of how well the item can execute or accomplish a desired set of consumer directed tasks)
- quality (or a measure of reliability (consistent dependable, accurate performance of expected service), assurance (or knowledge/courtesy) of others in conveying trust/confidence), tangibles (or appearance of physical aspects such as facilities, plant/equipment, people and communications), empathy (or like-mindedness/personal caring towards others), responsiveness (or promptly serving/helping others).

For still more concise consumer focusing, the corporate’s value deliverance systems are further sectioned [21], and assessed using [14][16] the following overarching retail, psychological and sport group classifications [1][32].
- actors seek to fulfil their chosen role plays, inquirers keep current and pursue new information
- valuers chase value for the money they expended
- socializers mix with friends and family
- adventurers thrill-seek and challenge themselves
- gratifiers (reduce their tension by treat themselves to something they perceive as new and special).

The IoT encompasses the corporate’s strategic positioning in providing its specific-consumer-targeted IoT business offerings. Where these are suitably directed, the consumer’s motive behaviors engage and move the consumer towards the corporate’s consumptive value propositions. The values derived then influence the consumer’s gratification choices – as exemplified by their IoT corporate loyalty.

**Consumer Loyalty**
Where the consumer is delivered sufficient value, a personal gratification growth can ensue. This loyalty is captured as belief and opinion (or cognitive loyalty); favorable (satisfying) attitudes (or affective loyalty); actioned tendencies via commitment or purchase intentions (or conative loyalty); and overt behavior (or action loyalty) [8].

IoT’s social interface connections if designed correctly helps deliver loyalty. Loyalty is a measure with multiple dimensions [8]. First, there is a belief dimension that encompasses opinion and cognition. For example a belief that X offers me more than Y, or gives me something extra or special. Second, there is a favorable or affective dimension that is attitudinal and satisfying. This typically delivers likes, or appreciation, or contentment – typically with a service or product or transaction. Third there is a transaction or conative dimension that shows a commitment, and is measured as a recommendation, or a spend, or a decision to...
reuse, or to continue to use. Lastly loyalty has a behavioral or actioning dimension where encouragement or a commitment to do something is actually carried through.

Thus the IoT offers the corporate new ways to engage with the global consumer market, and a starting measurement model for internet of things and its human interfacing behavior is shown as Figure 1.

![Figure 1. The MVL Model (IoT values servicing system model for consumer-focused corporates)](image)

**RESEARCH METHODS AND DATA ANALYSIS**

The MVL (motivators, values, loyalty) links a consumer’s value acquisition/creation through three, related, time-segmented blocks. The motivators block captures a consumer’s perceptions and expectations of desired values they can acquire. The value servicing block captures the consumptive values sensing, exchanges and transactions experienced by a consumer. The value outcomes block captures the gratification or value recognitions and realizations formed by a consumer.

To examine the relationships around Figure 1 and the innovative corporate we engage a mixed (qualitative and quantitative) methods approach. To analyse quantitative data we develop literature-supported online social environments surveys. Qualitative data is captured throughout the three MVL blocks using content analysis. From the descriptions of each dimension within each block we extract the actions/activities consumer’s preform in the social environment. This may be in the form of the consumer’s ideas, opinion, reviews, comments, tweets, images, feedback, etc. Themes and keywords are then isolated and grouped into measures for pathway analysis between blocks, and for interrelationships between dimensions. The strength of these relationships provides indirect evidence as to a consumer’s adoption of the corporate’s IoT opportunities. Even more concise consumer focusing, is achievable through [14][16] six segmenting (actors, valuers, socializers, adventurers, gratifiers).

Regression analysis can also be deployed to examine the success of the corporate’s IoT offerings through its revenue stream generation and the dimensions established through this mixed methods approach.

**CONCLUSION**

Thus an indirect pathway through social exchange is available to track and assess each consumer and their chosen use of the IoT through to the corporate’s transaction processes.

**REFERENCES**


EXAMINING THE EFFECTS OF THE INTERNET OF THINGS (IOT)
ON E-COMMERCE: ALIBABA CASE STUDY
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ABSTRACT
The Internet of Things (IoT) connects billions of things far beyond our imaginations. These internet-connected objects communicate with each other and share information, thereby nurturing business model innovation in various industries, notably including e-commerce. The IoT links objects that are offline in the current e-commerce business model, and generates an unprecedented amount of data on their status, product performance, and consumer behavior and preferences. Centralized IoT platforms hosted by e-commerce firms are continuously transforming this data into knowledge, generating a huge impact on e-commerce. In this paper, we review the conception of the IoT, the e-commerce road map, and the key elements of the e-commerce business model. We then study the case of Chinese e-commerce giant Alibaba’s IoT initiatives, and finally discuss how the IoT will transform e-commerce. We conclude that the IoT will not only create new value and catalyze innovation, but also transform e-commerce firms into information-flow intermediaries and knowledge generators. We also conclude that the IoT ecosystem will achieve economies of scale in industries other than e-commerce, and that the IoT will create new cross-industry market opportunities and competitive advantage.

Keywords: Internet of Things (IoT), Internet of Everything, e-commerce, business model, innovation, smart device, information sharing, big data analytics, cloud computing, Alibaba

INTRODUCTION
The Internet of Things (IoT), also called the Internet of Everything, became popular in the 2010s and in recent years has attracted the attention of both scholars and business decision-makers. The IoT connects billions of objects, such as buildings, air conditioners, coffee machines, washers, cars, animals and even people. The IoT connects things and people on an unprecedented scale; Cisco predicts that, although so far in 2015 more than 99% of things in the physical world are not connected, by 2020 the number of internet-connected devices and objects will reach 50 billion [9]. These internet-connected things communicate with each other and share information, nurturing business model innovation in various industries. The e-commerce sector is certainly not excluded from the IoT boom. The IoT connects objects that are offline in the current e-commerce business model, and generates an unprecedented amount of data on their status, product performance and consumer behavior and preferences. Centralized IoT platforms hosted by e-commerce firms are continuously transforming this data into knowledge, generating a huge impact on e-commerce.

THE INTERNET OF THINGS
The arrival of the IoT in the mid-1990s was not the outcome of thorough, innovative research, but resulted from an innovative idea aimed at solving a practical business problem through the use of readily available technology. In the mid-1990s, Kevin Ashton, the father of the term “Internet of Things,” was a brand manager at Procter & Gamble (P&G) London. When he visited P&G’s cosmetic retail stores, he found that one type of lipstick always appeared to be out of stock. This was a paradox, because, although P&G’s inventory system showed that a lot of the lipstick was in the retail stores’ warehouses, no one could find it. About the same time, Ashton met a manufacturer of a tiny radio-featured chip, an early implementation of the radio frequency identification (“RFID”) chip. Ashton had the idea of attaching the tiny chips to products, thereby allowing sales staff to identify both the presence and precise location of an item in inventory by using a wireless RFID reader. P&G sponsored Ashton in establishing a research center, the Auto-ID Center, to explore how the RFID technology might enhance inventory management. In one of his P&G presentations in 1999, Ashton coined the term “Internet of Things” [20].

The Global Standards Initiative on Internet of Things (IoT-GSI) defines the Internet of Things as a global information infrastructure for the information society, in which physical and virtual “things” are uniquely identified and connected to the internet [12]. There is no doubt that the wired or wireless internet is a key element in the IoT infrastructure. Other elements that uniquely identify an object and connect it to the internet are also necessary, elements including sensors, RFID tags and network adaptors. Applications (software) controlling this physical hardware are also indispensable. Connected objects continuously generate great amounts of data, thus calling for technologies such as mass data storage, big data analytics and cloud computing to transform data into knowledge and create value for both businesses and customers.

The IoT will generate huge amounts of data from internet-connected devices. Seagate Technology predicts that, by 2025, the IoT will generate more than 20 trillion gigabytes of data [22]. So far, in 2015, the IoT has penetrated a variety of industries, such as retailing, manufacturing, healthcare, insurance, home appliances, heavy equipment, airlines and logistics [17]. Three categories of
practical IoT enterprise applications enhance customer value: monitoring and control; big data and business analytics; and information sharing and collaboration [17]. McKinsey predicts that, by 2025, the IoT will have a huge potential economic impact and that its potential annual economic value will reach as high as US$11.1 trillion [18].

THE E-COMMERCE ROAD MAP
Kenneth Laudon and Carol Traver in their latest book, *E-commerce 2015: business, technology, society.* define e-commerce as commercial transactions conducted over the internet, using websites and mobile applications to facilitate such transactions among manufacturers, merchants, retailers and customers [16]. E-commerce firms thereby provide customer value and generate revenue and profits. Laudon and Traver also summarize three e-commerce developmental phases in the past twenty years: the invention of retail e-commerce from 1995 to 2000; the retail and services e-commerce consolidation period from 2000 to 2007; and the reinvention of e-commerce for retail, services and content between 2007 and 2015 [16]. Currently, there are five different types of e-commerce: B2C e-commerce, B2B e-commerce, C2C e-commerce, mobile e-commerce and social e-commerce [16]. The major e-commerce trends in 2014 and in 2015 are mobile and social e-commerce; mobile e-commerce platforms and social networks that provide search, advertising and payment services will create another e-commerce revolution [16]. Acting as online marketplaces, e-commerce websites and mobile applications that facilitate online commercial transactions allow manufacturers, merchants, retailers and service and content providers to list their products, services or content online. By visiting e-commerce websites or using mobile applications, customers can choose these products, services and content, place orders, and make online payments. The products, services and content will then be delivered to customers through delivery services or electronically, thus ending a typical e-commerce process.

Although the IoT has been developing rapidly in recent years, particularly in 2014 and 2015, the impact of the IoT on e-commerce receives limited discussion in research. This paper aims to fill this research gap.

E-COMMERCE BUSINESS MODEL
A business model is a series of planned activities aimed to create profit for an organization in a marketplace. This being the case, an e-commerce business model is one that aims to use and leverage the unique characteristics of the internet and the World Wide Web [16]. A successful business model, in both e-commerce and other areas, must effectively address eight key elements: value proposition, revenue model, market opportunity, market strategy, competitive environment, competitive advantage, organizational development and management team [16].

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value Proposition</td>
<td>How a company’s products or services fulfill its customers’ requirements [14].</td>
</tr>
<tr>
<td>Revenue Model</td>
<td>How a company generates revenue and creates profit.</td>
</tr>
<tr>
<td>Market Opportunity</td>
<td>The marketplace that a company intends to enter, as well as the company’s potential financial opportunities in that marketplace. Many small market segments constitute a marketplace.</td>
</tr>
<tr>
<td>Market Strategy</td>
<td>How a company plans to enter a new marketplace and attract new customers.</td>
</tr>
<tr>
<td>Competitive</td>
<td>Potential new entrants or other companies that offer similar products or services in the same marketplace.</td>
</tr>
<tr>
<td>Competitive</td>
<td>A company offers superior products or services at a lower price than its competitors do [23].</td>
</tr>
<tr>
<td>Organizational</td>
<td>How a company organizes its work in a targeted, goal-oriented manner.</td>
</tr>
<tr>
<td>Development</td>
<td></td>
</tr>
<tr>
<td>Management Team</td>
<td>Leaders of a company’s business unit, responsible for the business model.</td>
</tr>
</tbody>
</table>


ALIBABA AND ITS CLOUD COMPUTING ARM
Believing the internet would enable small companies to compete more effectively in domestic and global marketplaces by leveraging innovation and technology, Jack Ma established the Alibaba Group in 1999, when e-commerce, in the form of online retail, was being invented in China [1]. Sixteen years later, Alibaba Group operates a variety of businesses, including online marketplaces, online marketing, cloud computing and big data analytics, financial services for small enterprises and consumers, and logistical information services [1].
Table 2. The Businesses of Alibaba Group

<table>
<thead>
<tr>
<th>Business</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taobao.com</td>
<td>The largest online shopping marketplace in China.</td>
</tr>
<tr>
<td>Tmall.com</td>
<td>The largest online shopping platform for brands and retailers in China.</td>
</tr>
<tr>
<td>Juhuasuan.com</td>
<td>A popular Chinese group-buying marketplace.</td>
</tr>
<tr>
<td>AliExpress</td>
<td>A global marketplace for international customers.</td>
</tr>
<tr>
<td>Alibaba.com</td>
<td>A leading online platform for global wholesale trade.</td>
</tr>
<tr>
<td>1688.com</td>
<td>A leading online platform for wholesale trade in China.</td>
</tr>
<tr>
<td>Alimama.com</td>
<td>A leading online marketing technology provider.</td>
</tr>
<tr>
<td>Aliyun.com</td>
<td>A cloud computing and big data analytics provider.</td>
</tr>
<tr>
<td>(AliCloud)</td>
<td></td>
</tr>
<tr>
<td>Ant Financial</td>
<td>A provider of financial services for small enterprises and consumers.</td>
</tr>
<tr>
<td>Cainiao</td>
<td>A logistical information services provider.</td>
</tr>
</tbody>
</table>

Source: Adapted from “About Us”, Alibaba Group [1]

Founded in 2009, AliCloud (Aliyun.com) provides highly scalable cloud computing and data management services. It runs the network that supports Alibaba Group’s online and mobile e-commerce ecosystem, and helps third parties to participate in this ecosystem [1]. AliCloud also acts as the basic infrastructure for Alibaba’s IoT initiatives. In July 2015, Alibaba invested US$1 billion to improve its cloud computing services, aiming to compete with Amazon in e-commerce services [26]. In August 2015, Alibaba established its first international cloud computing headquarters in Singapore, expanding its cloud computing services from China to overseas [27].

ALIBABA’S IOT INITIATIVES

Alibaba started its IoT initiatives as early as 2014. It partnered both with appliance makers, such as Midea and Royal Philips, and with the automotive manufacturer SAIC Motor. It also launched open IoT platforms. In 2015, Alibaba established two business units to facilitate the adoption of the IoT in e-commerce, moving forward toward new business opportunities generated by the booming IoT development trend.

Building an Open IoT Platform in China with Midea

In March 2014, Alibaba signed a strategic cooperation agreement with Midea, a leading Chinese electrical appliance maker, initiating this Chinese e-commerce giant’s IoT trials. Under this agreement, Alibaba and Midea would jointly build an open IoT platform in China, based on AliCloud [25]. This newly-established platform would enable electrical appliances to connect to the internet, route communications, and allow users to control the appliances remotely and receive operational reports through applications installed on their mobile devices. At the same time, Midea launched its first “smart” air conditioner, which embedded a network adaptor, making it an internet-connected smart device. Midea selected Tmall, Alibaba’s B2C e-commerce platform, as the sole distributor of its smart air conditioner. In the launch ceremony, Midea announced that in the coming three years more than 50% of its air conditioners it made would be connected [25].

In practice, customers could send instructions to an air conditioner to start or shut down, or adjust temperature settings by using a Midea mobile application installed on their mobile phones. In the meantime, air conditioners could record operational data such as elapsed time, utility usage, fine particulate matter (PM2.5), temperature and humidity, and transmit this data to the open IoT platform hosted by AliCloud. Customers could then check operational reports through the Midea mobile application at any time. Customers could also use Alibaba’s mobile chat application Laiwang, which means “association with friends,” which was launched in April 2014, to control the air conditioners. In the future, Laiwang would enable manufacturers to diagnose their products remotely and provide after-sales services. It would also allow customers to communicate in real time with customer service representatives, ask for technical support, make maintenance appointments and pay for services via Alipay, Alibaba’s online payment platform [see Appendix 1 for the open IoT Platform jointly built by Alibaba and Midea].

Mr. Wenxin Wu, President of Household Air Conditioning at Midea, stated that this corporate strategy would be implemented in three phases: formulating a unified communications standard for IoT products and applications; achieving data-based operations...
allowing manufactures to conduct product enhancement and new product design by reviewing customer-behavior data and forming a complete industry supply chain for smart living by centralizing data, thus providing value-added services and changing the traditional home appliance industry’s business model [24]. Mr. Jian Wang, CTO of Alibaba, said that strategic cooperation between Alibaba and Midea would accelerate the adoption of AliCloud computing services and of the IoT in electronic appliances. This would have a huge impact on the Chinese home appliance makers and even the entire Chinese manufacturing industries, transforming traditional home appliance manufactures into smart home appliance makers [21].

In the future, Alibaba and Midea would open their unified communications standard and provide an application programming interface (API) for third-party applications. This would create a huge, open IoT platform, connecting billions of devices and providing data storage and analytics services.

An IoT Platform for Start-Up Businesses
In June 2014, Alibaba launched its IoT platform for start-up businesses, a platform aimed at lowering the barriers for entrepreneurs wishing to start smart hardware businesses [2]. The newly established IoT platform would integrate Alibaba’s marketing resources, cloud computing, big data analytics, information security solutions and other technologies to reduce smart-hardware manufacturing costs, accelerating IoT industry development. The IoT Platform for Start-Up Businesses included five elements: the Taoxiang sharing and marketing platform, a cloud computing platform, a developer platform, a data platform and an interconnection platform [3]. By providing this basic IoT infrastructure, Alibaba permitted its business partners to concentrate on business innovation, and allowed these innovations to reach targeted customers more quickly [3].

The Taoxiang platform provided business partners with marketing and promotion channels on Alibaba’s e-commerce platforms, such as Taobao and Tmall. This created a community allowing customers to communicate with manufacturers, understand smart products, and become involved in product design. The cloud computing platform, with its powerful computing capabilities, provided a cloud server, a server load-balancing service and an open data-processing service. The developer platform offered a variety of smart application solutions aimed at reducing software development costs and transforming ideas into products more efficiently and effectively. The data platform provided a centralized user login service through Taobao accounts, as well as big data analytics support. The interconnection platform connected supply chains, developers, manufacturers, merchants and customers [3].

Developing Internet-Connected Cars with SAIC
In July 2014, Alibaba reached an agreement with the Shanghai Automotive Industry Corporation (SAIC), a Fortune Global 100 company and Chinese state-owned automotive manufacturer, to develop internet-connected cars [5]. The new cars would include such elements as the Aliyun (AliCloud) operating system, Alibaba’s online music service platform (Xiami), an automatic navigation system and AliCloud computing services. The preliminary idea was to connect cars to the internet, allowing drivers and passengers to use Alibaba’s online services, such as online digital entertainment, maps and navigation, news and financial information. The project’s long-term goal was to construct a network linking tens of thousands cars to an integrated system that enabled information-sharing among cars, drivers and other users of the road, enhancing traffic management and even achieving auto-pilot driving [see Appendix 2 for the integrated IoT platform for cars] [6]. SAIC envisioned that this project was cross-industry integration in the era of the internet economy. These internet-connected cars were expected to be introduced into the market in August 2016.

Hosting Philips’ IoT Platform in China
In October 2014, Royal Philips, the Dutch electronics manufacturer, announced that it made an agreement with Alibaba to use AliCloud to host its IoT platform in China for healthcare and “smart” products [7]. AliCloud would provide data communications, data storage, data security, and big data analytics services for Philips’ new IoT devices by providing a wireless communication infrastructure. In the same month, Philips introduced its first HealthSuite device into China. The device, called the Philips Smart Air Purifier, and its mobile application were connected to AliCloud. The smart air purifier could monitor indoor air quality with an internal sensor. When the sensor found that air quality had reached unhealthy levels, it would send an instant message to AliCloud. AliCloud would then send a real-time alert message to the customer’s mobile devices [see Appendix 3 for Philips’ IoT platform in China].

As was the case with Amazon’s Dash Replenishment Service, which could automatically make online refill orders for laundry detergent, coffee and ink cartridges, the Philips air purifier would know when a filter would fail and send “right-time” replacement requests to its customers. On the other hand, Philips could acquire operational data on its products, automatically gathered by the air purifiers and sent to AliCloud. AliCloud could help Philips transform this data into knowledge to be used for product improvements and energy efficiency enhancement.

Another product that Philips would like to introduce to the Chinese market in the future is internet-connected LED lighting [8]. Global urbanization has accelerated the demand for more lighting and therefore energy, pushing the requirements for energy-efficient lighting solutions [8]. Comprised of IoT components such as a wireless-network adaptor, sensor and controller, a
connected light could automatically manage its energy efficiency or be controlled remotely by an application or in a control center. In fact, Philips had already introduced intelligent street lighting solutions in Europe and the US.

Mr. Patrick Kung, CEO of Philips’s Greater China Operations, said that China was the company’s second-largest market, and that the strategy that connected Philips’s smart products with the AliCloud ecosystem would create major innovations in mobile connectivity, cloud computing, and big data analytics [7]. Mr. Jian Wang, Alibaba CTO, commented that new technologies would make Philips’s internet-connected devices smart, enabling users to enjoy a more convenient and smarter life [8].

A 2015 IoT Milestone

In April 2015, Alibaba announced that it had established two new business divisions, the automotive business unit and the “smart living” business unit, representing a milestone for Alibaba’s IoT initiatives [10]. AliCloud will power these new business divisions and their IoT initiatives.

The automotive business unit will take the advantage of Alibaba’s big data on customers, including online purchasing history and product preferences. Alibaba would conduct big data analysis and provide financing services and marketing support to car manufacturers and dealers. Alibaba will allow car manufacturers and dealers to upload their catalogues to its e-commerce platform, Tmall, and offer financing deals to potential customers, creating an innovative model for generating revenue. By April 2015, Alibaba had partnered with around 50 car manufacturers, including BMW, Toyota and Volkswagen, and with more than 10,000 car dealers and 20,000 car service providers in China [11]. SAIC said it would invest US$161 million to jointly develop internet-connected cars with Alibaba [10]. At the same time, Alibaba’s Tmall would use knowledge gleaned from big data analytics and cloud computing to match buyers and dealers, recommend the right cars to the right buyers and provide loans to people purchasing cars.

The “smart living” business unit will integrate Taobao’s and Tmall’s electronic appliance sections to create a new smart home-appliance category. The new e-commerce platform will allow small businesses to raise capital online. It will also allow manufacturers and merchants to promote and sell products with built-in internet components. In addition, Alibaba will continue to provide cloud computing and data analytics services to customers, merchants and manufacturers after the completion of online purchases, expanding its business scope beyond that of current e-commerce firms.

DISCUSSION

Retailers will still sell, but as web-connected products generate a wealth of information about consumers, online merchants will want to rethink their role beyond the transaction. This is not e-commerce in the way a lot of people think about it now... This is about building a very intelligent relationship with consumers [19].

- James McQuivey, Vice President, Forrester Research

We apply the key elements of the e-commerce business model [16] to discuss how the IoT will transform current e-commerce, utilizing the case study of Alibaba’s IoT initiatives.

Value Proposition

In the current e-commerce business model, e-commerce firms fulfill customer requirements by providing personalized recommendations and customizations based on online purchasing history and preferences, reducing search and price discovery costs, and facilitating online transactions [4, 13]. For example, Amazon’s online shopping platform, which functions as an online marketplace, and Kindle, which delivers e-books instantly, allow customers to choose products and services online conveniently, any time and any place, as long as their computers, mobile phones or tablets are connected to the internet, thereby providing unparalleled selection and convenience [16].

By linking things that are offline in the current e-commerce business model, such as manufacturers, customers, and products and services, the IoT will extend e-commerce far beyond the current online shopping-platform concept, and will create new customer value, such as more convenient and smarter living and highly personalized products and services. The IoT will also make sophisticated information-sharing among manufacturers, e-commerce firms, customers, and products and services possible. Unlike current e-commerce business transactions, which end when products or services are delivered to customers, IoT e-commerce enables Alibaba to continue to provide information sharing, cloud computing and knowledge transformation services after completion of an online purchase, thus creating value for both end users and manufacturers.

The innovative Midea smart air conditioner and Royal Philips smart air purifier, both connected to the internet and AliCloud platform, allow customers to control the devices remotely and receive real-time alerts and operational reports. These smart devices also allow manufacturers to conduct remote product diagnoses and provide after-sales services. Thus, home appliance manufacturers create customer value for end users around convenience, safety, and smarter living, while Alibaba creates customer value for manufacturers around efficiency and effectiveness of after-sales service and product improvement. Similarly,
connected cars create customer value by allowing drivers and passengers to enjoy Alibaba’s online digital entertainment, navigation, news and information services. At the same time, manufacturers can design and make highly personalized products for customers based on product operational data, as well as data on customer preferences and behavior. Manufacturers can even invite customers to join the product design process.

Alibaba’s services, which match buyers and merchants and provide financing services and manufacturer marketing support, coupled with its open IoT platforms, allow existing manufacturers and start-ups to innovate and exploit IoT’s prospective business opportunities. Thus, the economies of scale of IoT e-commerce are huge and not limited to the e-commerce sector alone. As Alibaba’s CTO said, adoption of IoT in electronic appliances will affect the home appliance makers and even the entire Chinese manufacturing industry, transforming manufacturers’ current business models. The software industry, which designs operating systems and applications, will definitely benefit as well.

**Revenue Model**

In the current e-commerce model, revenues are generally generated from advertising (e.g., Yahoo and Google), content subscriptions (e.g., Wall Street Journal and Financial Times), transaction services (e.g., eBay), sales (e.g., Amazon and Best Buy) and referral services (e.g., MyPoints and MoneyBack)[16].

To capitalize on IoT business opportunities, e-commerce firms will transform themselves from commodity-flow intermediaries to information-flow intermediaries. Their businesses will expand from facilitating online transactions to transforming shared information into knowledge with practical applications.

Alibaba’s AliCloud hosts IoT platforms for manufacturers such as Midea, Philips and other firms, facilitates the connection of things and information sharing, conducts big data analytics and cloud computing, and converts data into knowledge. All these new service offerings create additional revenue streams for Alibaba that did not exist in the current e-commerce business model. In addition, Alibaba’s two newly established business units, automotive and “smart living,” provide financing deals to car manufacturers and consumers, and allow small businesses to raise capital online. Alibaba will receive revenue from such innovative services that could not have been imagined within the current e-commerce scenario.

**Market Opportunity and Market Strategy**

In the current e-commerce business model, companies promote their products and services through online advertising and cross-selling. Companies also invite current or potential customers to share information about existing products and services and about customer experiences. For example, Twitter and YouTube encourage users to post content and share information on the websites for free, and these users thereby conduct social network marketing for Twitter and YouTube[16].

Alibaba allows its business partners, such as manufacturers, information and communications technology (ICT) companies, and small businesses with limited IoT capability, to jointly build and utilize its open IoT platforms, which constitute an integrated IoT ecosystem. Alibaba, through its IoT ecosystem, gathers and stores big data on customer preferences and behavior, and encourages customers to join product design and marketing processes. Thus, the aims of marketing are not only to promote existing products and services, but also to invite customers to improve, as well as jointly create, innovative and more highly personalized products and services. Customers will enjoy the products and services they jointly design more, thereby enhancing marketing effectiveness.

**Competitive Environment and Competitive Advantage**

In the current e-commerce business model, e-commerce companies can leverage their existing experiences to create new competitive advantage. For example, Amazon established its online grocery business by leveraging its huge customer database and years of experience in e-commerce [16]. Customers can choose products and services from a certain e-commerce website or other websites that provide similar or identical products and services. In this scenario, superior products and services and lower prices make for competitive advantage [23].

As is the case with Amazon, Alibaba could, when moving into the IoT market, leverage its enormous customer database, including credit data and customer preferences and browsing behavior, its AliCloud capability, its huge merchant networks and multiple e-commerce marketplaces, and its sixteen years of e-commerce operational experience. Alibaba could generate competitive advantages by using its integrated IoT ecosystem, thus establishing standards and creating valuable knowledge. On the other hand, smart devices could notify end users to reorder complementary items at the right time, before existing items run out, or automatically make orders online, thus reducing fierce manufacturer competition for repeat buying.

**Organizational Development and Management Team**

Organizational development and management team are as important as the other elements in evaluating a business model) [15, 16]. The two newly established Alibaba business units, automotive and “smart living,” integrate resources, accelerate Alibaba’s IoT
adoption and create a milestone for the Chinese e-commerce giant’s IoT initiatives. An examination of how Alibaba manipulates these two elements when designing and implementing IoT initiatives requires further information from company interviews.

We summarize Alibaba’s case in table 3. In this table, we examine Alibaba’s innovative IoT practices and applications in 2014 and 2015 and their impact. These innovative IoT practices and applications include Alibaba and Midea’s open IoT platform for home appliances, Alibaba’s open IoT platforms for start-up businesses, Alibaba and SAIC’s internet-connected car planning, Philips’s AliCloud-hosted IoT platform in China, and Alibaba’s 2015 IoT milestone. We divide Alibaba’s innovative IoT practices and applications and their impact into five groups, based on the e-commerce business model [16], to address how Alibaba’s IoT initiatives create value, generate revenue, create market opportunities, achieve competitive advantage, and boost organizational development.

Table 3. The Case of Alibaba

<table>
<thead>
<tr>
<th>Element</th>
<th>The Case of Alibaba</th>
</tr>
</thead>
</table>
| Value Proposition| • Create customer value for end users around convenience, safety and smarter living.  
                    • Create customer value for manufacturers around efficiency and effectiveness of after-sales service and product improvement.  
                    • Facilitate information sharing and create knowledge.  
                    • Create business opportunities for start-up IoT businesses.  
                    • Generate economies of scale for other industries, such as the manufacturing and software industries.                                                                                                                                                                   |
| Revenue Model    | • Alibaba receives revenue from IoT platform hosting, big data analytics, cloud computing, knowledge transformation and online capital-raising services.  
                    • Manufacturers and small businesses receive revenue by raising capital online.                                                                                                                                                                                                  |
| Market Opportunity| • Jointly build open IoT platforms with manufacturers (IoT ecosystem).  
                    • Connect customers and manufacturers, and push customer participation in product design and marketing, enhancing marketing effectiveness.                                                                                                                                                     |
| Market Strategy  |                                                                                                                                                                                                                                                                                       |
| Competitive Environment | • Establish standards and provide valuable knowledge generated by its integrated IoT ecosystem.  
                                 • Reduce fierce competition among manufacturers in the marketplace through automatic repeat buying.                                                                                                                                                                           |
| Competitive Advantage |                                                                                                                                                                                                                                                                                     |
| Organizational Development Management Team | • In April 2015, Alibaba established two new business units, automotive and “smart living.”                                                                                                                                                                                                                                                      |

We summarize how the IoT will transform current e-commerce business in table 4. In this table, we apply the key elements of the e-commerce business model [16] to IoT e-commerce practices and applications. We highlight the effects of the IoT on e-commerce with respect to value proposition, revenue models, marketing, and competitive advantage. We also highlight the differences between current and IoT e-commerce business models to address how the IoT creates value for end users, manufacturers and small businesses, produces new revenue absent from the current e-commerce scenario, gives rise to market opportunities, enhances marketing effectiveness, and generates new competitive advantage.
Table 4. The summary of how the IoT will transform current e-commerce

<table>
<thead>
<tr>
<th>Element</th>
<th>Current E-commerce Business Model</th>
<th>IoT E-commerce Business Model</th>
</tr>
</thead>
</table>
| Value Proposition      | Highlight: The IoT creates new customer value, advances information sharing, and catalyzes innovation. | • New customer value, such as more convenient and smarter living, and highly personalized products and services.  
• Sophisticated information-sharing among manufacturers, e-commerce firms, customers, and products and services.  
• Business opportunities for manufacturers and small businesses to innovate and transform their business models.  
• IoT economies of scale in industries other than e-commerce. |
|                        | • Personalized recommendations; reduction of search costs and prices; facilitation of online transactions [4, 13].  
• Unparalleled selection and convenience [16]. |                                                                                                 |
| Revenue Model          | Highlight: E-commerce firms will transform themselves into information-flow intermediaries, and their businesses will expand to knowledge generation. | • Revenue from facilitation of information flow.  
• Revenue from the generation of knowledge from big data analytics and cloud computing.  
• Revenue from online capital-raising services. |
|                        | • Advertising, content subscriptions, transaction services, sales, and referral services [16]. |                                                                                                 |
| Market Opportunity     | Highlight: Cross-industry parties jointly build an integrated IoT ecosystem; the IoT will facilitate higher degrees of customer participation. | • Construction of integrated IoT ecosystem.  
• Consumers’ active involvement in product design and marketing activities. |
| Market Strategy        | • Online promotion of and information-sharing on products and services developed by manufacturers. |                                                                                                 |
| Competitive Environment| Highlight: The IoT will create competitive advantages other than lower prices.                     | • Competitive advantage generated from integrated IoT ecosystem, standards and valuable knowledge.  
• Reduction of competition through automatic repeat buying. |
| Competitive Advantage  | • Superior products and services and lower prices [23].                                           |                                                                                                 |
| Organizational         | Further information is needed to answer the question of whether e-commerce firms, when designing and implementing IoT initiatives, will manipulate these two elements differently than they do in their current e-commerce operations. | Development                                        |
| Management Team        |                                                                                                  |                                                                                                 |

CONCLUSION

The Chinese e-commerce giant Alibaba, as well as Amazon and other e-commerce firms worldwide, made great efforts to exploit potential IoT business opportunities in 2014 and 2015. This trend will continue in the coming years. By linking things that are offline in the current e-commerce business model, the IoT will disrupt the current perception that e-commerce is merely an online shopping platform. The IoT generates an unprecedented amount of data. E-commerce firms jointly build IoT ecosystems with partners in various industries, and are continuously transforming data into valuable knowledge, causing IoT’s economies of scale to expand beyond the e-commerce sector.

In this paper, we have applied the key elements of the e-commerce business model to discuss how the IoT will transform current e-commerce by utilizing the case study of Alibaba’s IoT initiatives. We conclude that the IoT will not only create new value and catalyze innovation, but also transform e-commerce firms into information-flow intermediaries and knowledge generators. We also conclude that the IoT ecosystem will achieve economies of scale in industries other than e-commerce, and that the IoT will create new cross-industry market opportunities and competitive advantage.

Our paper is one of the first studies on the innovative IoT practices and applications that Alibaba, the largest e-commerce company in the world, implemented in 2014 and 2015. The study compares the current e-commerce business model with the IoT e-commerce business model, systematically addresses the effects of the IoT on e-commerce, and expands the application of the theoretical e-commerce business model into IoT e-commerce. The study also permits e-commerce firms, manufacturers, small
IoT e-commerce applications are in an initial stage in 2015. Widespread IoT adoption in e-commerce depends on many factors, such as stable ICT infrastructure, data security, customer privacy and trust regarding information sharing. The IoT initiatives of e-commerce firms or manufacturers could be further evaluated by using information system success models. Moreover, e-commerce firms’ and consumers’ information-security awareness, and consumers’ willingness to accept such IoT offers as smart home appliances, smart cars, and other smart living products, are essential to the successful implementation of these IoT initiatives. Future research on these issues is therefore necessary.

ACKNOWLEDGEMENT
The research was supported by RGC grant (UGC/IDS12/14) and RGC GRF grant (719409E 09-12) from the Research Grants Council, HKSAR.

REFERENCES
APPENDIX 1: THE OPEN IOT PLATFORM JOINTLY BUILT BY ALIBABA AND MIDEA

![Diagram of Open IoT Platform]

APPENDIX 2: THE INTEGRATED IOT PLATFORM FOR CARS

![Diagram of Integrated IoT Platform for Cars]
APPENDIX 3: PHILIPS’ IOT PLATFORM IN CHINA

Smart Products

Mobile Devices

Philips’ IoT Platform in China

AllCloud

Control Center

Philips

Remote control

Operational data

Real-time alert

Manufacturer
EXPLORING DRIVING FACTORS FOR CONSUMERS’ ACCEPTANCE OF E-COMMERCE IN CHINESE RURAL AREAS

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ABSTRACT
Despite the rapid development of E-Commerce in global cities, residents in relative lagging areas are still facing issues to benefit from this technology. Such issues are like lack of computing equipment, inadequate technical skills, and expensive delivery services. To alleviate such issues, Chinese E-Commerce organizations (e.g., Alibaba) built up thousands of service stations in Chinese rural areas, and provided resources and services for local residents. In this research, we aim to investigate consumers’ acceptance of E-Commerce in such areas. The potential factors which may influence the consumers’ acceptance of E-commerce in such areas are explored according to a literature analysis. We propose a research model by incorporating the factors, such as perceived accessibility, perceived safety, and social influence, based on the Technology Acceptance Model. An empirical study is planned to validate this research model in the future.

Keywords: E-Commerce, User Acceptance, Consumer Acceptance, Chinese Rural Areas, Developing Countries.

INTRODUCTION
During recent years, E-Commerce has been widely used in global cities. Urban residents have benefited a lot from on-line shopping. However, due to comparatively lagging economic situation and distributed population, the use of E-Commerce in Chinese rural areas has faced challenges. Such challenges are like lack of Internet access, lack of reliable delivery systems and inadequate technical skills. To alleviate such issues, Chinese organizations, such as Alibaba and Jingdong, have set up thousands of service stations/ stores in villages since 2014. In these service stations, computers, Internet access, technical support, and centralized delivery services are provided. In this research, we investigate to what extent E-Commerce in such service stations is accepted by local consumers. Based on a literature review, we propose a research model by incorporating the factors, such as perceived accessibility, perceived safety, and social influence, in addition to the Technology Acceptance Model. The remainder of this article is organized as below. Section 2 introduces background knowledge. Section 3 proposes a conceptual model based on TAM and other important factors. Based on this model, an empirical study is planned in Section 4. We also conclude the article in Section 4.

BACKGROUND
We introduce some background information in this section.

The Acceptance of E-Commerce
E-Commerce has developed quickly during the past decade. In order to better understand it and provide useful inputs for further development of it, researchers investigated models to evaluate and predict the consumers’ acceptance of E-Commerce. One of the best known models is the Technology Acceptance Model (TAM) [5]. In TAM, Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) are the two drivers of Intention to Use (IU). Pavlov used TAM and proposed to add factors of Trust and Perceived Risk to evaluate E-Commerce considering the uncertainty of E-Commerce environment [20]. A number of researchers have examined the TAM model for E-commerce, including the World Wide Web (WWW) [14], Intranet [13], desktop video conferencing in virtual workgroups [23], etc. In these studies, PU was found to have a strong effect on the adoption of new e-commerce technologies.

Some other researchers chose the Theory of Planned Behavior (TPB) [3] or the Unified Theory of Acceptance and Use of Technology (UTAUT) [2, 10, 19] in the field of E-Commerce. TPB [1] is a theory that links beliefs and behavior. In TPB, Attitude toward behavior, Subjective Norms (SN), and Perceived Behavioral Control (PBC), shape an individual's Behavioral Intentions (BI) and Behaviors. Based on TAM, TPB and several other widely used models, UTAUT [24] aims to explain usage intention (to an information system) and subsequent usage behavior. In UTAUT, Performance Expectancy (PE), Effort Expectancy (EE), Social Influence (SI), and Facilitating Conditions (FC) are the four key constructs that determine the usage intention and behavior.

Particularities of E-Commerce Acceptance in Lagging Areas
Despite the wide adoption of E-Commerce in developed cities, challenges and issues were found when E-Commerce was applied in comparatively lagging areas [9, 15-17]. In such areas, due to low income level, many families do not have personal computers and broadband at home. People in such areas often do not have necessary skills to operate computers and perform online transactions. Other infrastructures (e.g., delivery services) are expensive and not convenient due to the distributed population. What is more, people living in rural areas intend to follow more conventional living habits than people living in cities. These people are often influenced by other social relations. According to previous research [9, 15-17], in such areas, the consumers’ major concerns to the use of E-commerce are as follows: high access cost to equipment and network, transaction trust, shopping for social, lack of skills, immature payment system, logistics, etc. Correspondingly, the acceptance of consumers living in such areas may be determined by different factors than consumers living in developed cities.

The Fifteenth International Conference on Electronic Business, Hongkong, December 6-10, 2015

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E-Commerce Service Stations/Stores in Chinese Rural Areas

More than half of Chinese areas are rural areas. Following the success of E-Commerce in Chinese cities, the huge potential of E-Commerce markets in rural areas has been aimed at by E-Commerce businesses since several years ago. Alibaba has established thousands of E-Commerce service stations in village centers since October 2014. From almost the same time, JingDong began set up E-Commerce service stores in villages also. On the other hand, emerging organizations such as LeCunTao [7] tried to adapt existed grocery stores to provide similar services. Common services provided by such E-Commerce service stations or stores include: shared places and devices for transactions or other social activities, integrated transaction and delivery services, technical support, and other value-added services.

FACTORS INFLUENCING CONSUMERS’ ACCEPTANCE OF E-COMMERCE IN CHINESE RURAL AREAS

In this section, we propose a research model to evaluate and predict consumers’ acceptance of E-Commerce in Chinese rural areas.

Overall Research Model

Among existing models (e.g., TAM, TPB and UTAUT), we choose TAM as the basic model. This is because e-commerce is heavily technology-driven [20]. In addition, TAM is more parsimonious than other models. For instance, UTAUT includes too many variables to predict usage intention and behavior. Because E-Commerce in Chinese rural areas is now developing and changing very quickly, basing on a precise model can help identify the most important drivers. It was also found that some factors in UTAUT (e.g., Gender and Age) did not have a significant positive impact on users’ behavior or intention in the context of rural areas [4].

Compared to urban areas, rural areas are of a comparatively lower economic level. In addition, residents in such areas live with more conventional life styles. Therefore, we proposed to involve extra driving factors in addition to the original PU and PEOU. These newly added factors will be introduced in detail in the sub-sections followed. The overall revised research model is presented in Figure 1.

Figure 1. A Revised TAM Model for E-Commerce Acceptance in Chinese Rural Areas

Perceived Accessability

We use Perceived Accessability to describe the extent to which rural consumers could access necessary resources for online transactions. Rural areas are usually lagging behind in the development of infrastructure such as computing devices, telecommunication, delivery services etc. [16]. Residents in rural areas may not be able to gain E-Commerce information through modern media. Due to low affordability and educational level [9], they may not have computers, smart phones, or internet [6] to use. They may not have adequate technical skills to perform on-line transactions as well. Three aspects are proposed. The first aspect is Wallbrushing. In Chinese rural areas, information is often published and scattered through conventional channels such as outdoor walls, banners, publicity boards, loudspeakers, etc. Chinese E-Commerce businesses are utilizing such conventional channels to advocate their projects and have received good results [12]. We use “Wallbrushing” referring to the use of all available channels from where rural residents get to know information about E-Commerce. The second aspect is Facilitating Condition. This is defined as “the degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system” [24]. Computing system, internet connection, and delivery system are all included in this aspect. In [21], the chance to make better deals, the convenience of a delivery service and the independence of opening hours were found as the most influential positive factors for online shopping adoption. Technical Support is the third aspect of Perceived Accessability. Technical Support should be provided to help rural consumers perform...
online transactions. Therefore, we propose the following hypotheses:

**H1:** Perceived Accessibility of E-Commerce positively influences the user’s Intention to Use E-Commerce in Chinese rural areas.

**H1-1:** Wallbrushing positively influences the Perceived Accessibility of E-Commerce in Chinese rural areas.

**H1-2:** Facilitating Condition positively influences the Perceived Accessibility of E-Commerce in Chinese rural areas.

**H1-3:** Technical Support positively influences the Perceived Accessibility of E-Commerce in Chinese rural areas.

**Perceived Safety**

We have identified three key aspects which may bring significant impact to the Perceived Safety of rural residents regarding E-Commerce. Compared with residents in cities, rural consumers may not be familiar with other payment methods than cash payment. Allowing Cash payment makes rural residents feel safe about on-line transaction. In addition to the payment methods, previous research denoted that missing touch and feel experiences was the most influential negative obstacle for E-Commerce application [21]. Similarly in [6], it was pointed out that rural residents were discouraged from purchasing online because they could not inspect goods beforehand. This issue may be alleviated by providing Payment on Delivery. On the other hand, quality assurance is considered as an important factor when E-Commerce transactions happen [22]. Unconditional Return can be provided to rural residents to avoid their concern about goods quality. In [11], the authors also emphasized the importance of on-time delivery, ease of payment, cash on delivery, and product replacement policy. Therefore, we propose the following hypotheses:

**H2:** Perceived Safety of E-Commerce positively influences the users’ Intention to Use E-Commerce in Chinese rural areas.

**H2-1:** Cash payment positively influences the Perceived Safety of E-Commerce in Chinese rural areas.

**H2-2:** Payment on Delivery positively influences the Perceived Safety of E-Commerce in Chinese rural areas.

**H2-3:** Unconditional Return positively influences the Perceived Safety of E-Commerce in Chinese rural areas.

**Social Influence**

“Social Influence is defined as the degree to which an individual perceives that important others believe that he or she should use the new system” [24]. Social Influence may be from Leaderships and Familiarities. In some developing countries such as Tanzania, most organizations have strong lines of authority. And thus it was crucial to gain support from the top lines of management [4]. Situation is similar in China. In [16], it was indicated that leaders and institutions can often have a significant impact on the rural community. Chinese E-Commerce businesses put emphasize on finding proper leaders for their village service stations/stores. Alibaba recruited partners to run their service stations [8], while Cuncunle have been recruiting new service stations/stores. Alibaba recruited partners to run their service stations [8], while Cuncunle have been recruiting new service stations/stores. Alibaba recruited partners to run their service stations [8], while Cuncunle have been recruiting new service stations/stores. Alibaba recruited partners to run their service stations [8], while Cuncunle have been recruiting new service stations/stores. Alibaba recruited partners to run their service stations [8], while Cuncunle have been recruiting new service stations/stores. Alibaba recruited partners to run their service stations [8], while Cuncunle have been recruiting new service stations/stores. Alibaba recruited partners to run their service stations [8], while Cuncunle have been recruiting new service stations/stores. Alibaba recruited partners to run their service stations [8], while Cuncunle have been recruiting new service stations/stores. Alibaba recruited partners to run their service stations [8], while Cuncunle have been recruiting new service stations/stores.

In [25], we already heads of villages or college students serving as village officers [25]. Social influence can also come from familiarities. In [22], trust and reputation were considered to be important when E-Commerce transactions happen. Personal trust was thought to be one of the three main factors that shaped Chinese E-Commerce application [18]. Therefore, we propose the following hypotheses correspondingly:

**H3:** Social Influence of E-Commerce positively influences the users’ Intention to Use E-Commerce in Chinese rural areas.

**H3-1:** Leaderships positively influences the Social Influence of E-Commerce in Chinese rural areas.

**H3-2:** Familiarities positively influences the Social Influence of E-Commerce in Chinese rural areas.

**FUTURE WORK AND CONCLUSION**

In this article, we have introduced the particularities of applying E-Commerce in rural areas in China. We investigate factors which may influence the consumers’ adoption and acceptance. We proposed a revised TAM model by incorporating these factors into TAM. This model was proposed based on a literature analysis. In order to validate this model, we have planned an empirical study in the near future. In the empirical study, we will perform a field study to observe and probe actual consumers’ attitude in a qualitative way. Basing on the results, we adjust the conceptual model and the corresponding instrument. Then, we will perform a survey to quantitatively validate the research model.

**REFERENCE**


The Fifteenth International Conference on Electronic Business, Hongkong, December 6-10, 2015
FORM ONLINE TO ON-CLOUD: THE SOCIOLOGICAL CRITICISM OF ONLINE TARGETED ADVERTISING

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ABSTRACT

As a kind of information diffusing channel, online targeted advertising, which can accurately deliver the commercial information to the audiences from specific hobbies and interests, actual demand and attitude of tendency by analyzing the trail of their internet using, shows an obvious effect. Meanwhile, with the development of the concept and technology of the CLOUD, more comprehensive and accurate data analysis of targeted advertising has been made into practice. This research makes a calm thinking on the online targeted advertising from the focus of criticism. It expounds the protection of individual privacy from the focus of public sphere constructing, the advantages and disadvantages of consumerism from the focus of cultural study and the construction of political, economic and cultural system in benign society from the focus of Political Economy of Communication. At last, under focus of cultural imperialism, the research expounds issues of online targeted advertising in the area of international economic development and intercultural communication. All these works are based on the expectation of the balance between the commercial logic and cultural logic.

Keywords: online targeted advertising, communicating effect, sociological criticism.

Advertiment is the product of commercial logic and it plays a very important role in the development of commodity society. The prosperity and improvement of advertising industry represent the achievement of economic development, and also the level of social productivity. The development of advertisement is tightly connected with the development of mass communication media. Every significant revolution of media in human history would lead the major breakthrough of information communication. From tying knots to beacon-fire, printing to radio, broadcast to internet, the speed and coverage of information spreading always had a tremendous enhancement. As a kind of special information form, advertisement also keeps a huge changing with the development of mass media, from inherent means of expression to information carrier, then to communication strategy and technique of originality.

In the developing process of advertisement industry, the most concerned issue of practitioners and researchers is the effect of the advertising. “I know half of my advertising expense has been wasted, but unfortunately, I don’t know which half it is.” This sentence has been the classics of describing the effect of advertising. In order to make the best result of advertising, communication scholars, based on the sociological research methods, did a lot of researching works from the point of psychology and communication, such as bullet theory, inoculation theory and innovation-diffusion theory. Most of Economists do the research from economy principles and marketing strategy. They work out lots of theoretical model and communication strategy on the base of multi-channel consumer investigation and data analysis of information technology.

Based on the deep analysis of huge behavior database of internet search engine users, online targeted advertising makes the one-to-one communication to the certain group of audience into reality by locking on by their hobbies, interests, actual demand and attitude of tendency. Meanwhile, with the development of internet and mobile technology, especially maturity of the concept and application of CLOUD, online, as the latest method of information dissemination, is being substituted by on-cloud which is a completely new mode of advertisement and provides more comprehensive and accurate data analysis for targeted advertisement.

Nevertheless, along with maximized effect for advertising practitioners and benefit for advertisers that targeted advertisement brings, many social problems also come up with the appearance of it, such as protection of individual privacy, flourish of consumerism and surplus of useless information. These problems will make a probabilistic influence to the social politics, economics and culture, also the construction and development of public sphere. Even more, the advertising communication system, based on the far-advanced science and technology and well-developed commercial system, will make a new wave of cultural imperialism.

Consequently, this research, on the focus of criticism, expounds the history and developing stage of nowadays, analyzes the information spreading essence of online targeted advertising under the research methods of political economy of communications and cultural imperialism. Based on the benign development of society and culture, some advices are also given to the advertising practitioners when they make the targeted advertisement.
THE HISTORY, CURRENT CONDITIONS AND DEVELOPING TENDENCY OF ONLINE TARGETED ADVERTISING

History: Lock the Demand of Audiences Accurately
Making a general survey of the information spreading history of human society, we realize that the purpose of media dissemination is to enlarge the coverage of information spreading as large as possible so that more and more audiences could receive it. The development of mass media is also following this purpose. With the developing of hundred years, some of the media become the “mass media” with a great power of influence. Newspaper, radio, television and internet are the main news information spreading media of them. Although advertisers hope more and more people could receive the advertising information, but different from the news, advertisement does not rely on “mass” very much. The advertisers are always thinking the relationship of advertising cost and effect. Any advertisement of any product has a specific target consumer group which is hiding in mass and can be recognized by some features, such as gender, age, location, culture, knowledge and so on. The advertisers, who are high on spreading the advertisement as wide as possible, recognize that the costs of the ad waste a lot, even all. So, advertising agencies and scholars begin to attempt substituting the mass by those who are suitable for the products. That is minority diffusion.

Media vehicle is an interesting word in the advertising research. It means the particular form in the media, such as a specific program on a TV channel or a specific page of a newspaper. Every vehicle has different coverage and audience, of course also different price and style. The advertisers always choose the vehicle which has the same or similar positioning with their products. For example, luxury or automobile always choose quality newspapers, athletic equipment will choose sports channel and the brands positioned on mid-age ladies will choose popular teleplays.

Direct mail advertising is another popular form of minority diffusion advertisement. It is defined as the direct advertising that advertisers print the commercial information as the mail or other forms of propaganda and post to the people who might be consumers. It is delivered by the post network and always includes the form of booklets, brochures, catalogs and sales letters. Direct mail advertising is provided with the function of information spreading and also with the features of accurate market positioning, strong pertinence, high timeliness, obvious individuation and good confidentiality. In 1998, 39.2 billion dollars was put into commercial mailing and direct mail advertising, along with television, became the second big advertisement media in United States [9].

Online: Technology and Effect of Targeted Advertising
Targeted advertising judges the people’s preference and power of consumption by collecting their information and makes the personalized advertisement combination for single people [16]. Online targeted advertising could automatically deliver the commercial information to the periphery of similar content on the webpage according by user’s demands or preference, location, accessing history and other information. Advertiser could dig the data of user’s information, relationship and online behavior, search and analysis the content of webpage by semantic matching system, and tracking user’s behavior through monitoring system. And then, they could filtrate the attribute of different users and make an accurate web advertising exhibition. This makes user’s demands directly docking with the ad supply and gives a full play to the effect of web advertising.

Online advertising targeting technology includes two main aspects, rule-based targeting and model-based targeting. Rule-based targeting is doing Boolean Search in the advertising database according user’s attribute information and gets the advertisement suitable for the rules. It can be divided into demographic targeting and geographic targeting. Model-based targeting is the technology of framing the ad matching model, which is aimed at information of user’s behavior and network environment and confirming the percentage of all the information according by different algorithm. The model can help advertiser choosing the most matched ads in the advertising database. Model-based targeting includes behavioral targeting, retargeting and contextual targeting [19].

The influence factor to the effect of online targeting advertising can be reduced into website point, advertising point and audience point. Website point means the reputation. It is the audiences’ psychological acceptance level to the website from the point of popularity and reputation. Advertising point includes the vitality, information of background and purchasing, etc. No matter the content or modality, every element of the advertisement will influence the effect of spreading. Audience point mainly focus on the individual privacy. Some scholars claim that the reputation of the website will not influence the psychological effect of behavioral targeting advertisement, but background information, purchasing information and vitality will, on some level. Purchasing information will not influence the motion of user but privacy focusing will lead negative effects to the result behavioral targeting advertisement.

With the development of mobile network devices, mobile media has become an important part of our daily life, and many advertisers also pay close attention on this new media of advertising. Mobile devices are eager to get the equal information with the less computational capabilities, so cloud appears. Cloud is always understood as the interaction of information technology infrastructure and pattern of utilization, or delivering and using pattern of services. It also means a lot to targeting advertising. Cloud computing model of services’ increasing, using and delivering based on internet. It always refers to providing dynamic extended virtualized resources via internet. According to Prof. Liu Peng, Deputy Director and secretary general of China Cloud Computing Expert Advisory Committee, cloud computing is the service of providing a kind of cheap elastic distributed

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calculating capability [2].

The information contact behaviors of using cell or tablet are completely different from using newspapers, broadcast and television. The individuality is more evident. Compared with using computer, the feature of privacy and the increasing rate of using are more obvious. So, based on more enormous data analyzing devices, the effect of targeted advertising will be more remarkable. This is becoming an important development tendency of online targeted advertising.

**ONLINE TARGETED ADVERTISING UNDER THE FOCUS OF CRITICISM**

**Destruction of Individual Privacy: Targeted Advertising and Framing of PublicSphere**

In order to pursue the maximization of advertisement effect, in the process of behavioral targeting, the advertisers collect mass of user’s behavior information, and this may be an invasion of audience’s privacy. More important, whatever the audiences use, computers or mobile devices, this kind of invasions are always unconscious. The information of individual privacy is stolen by advertisers in an oversimplified and crude way while the audiences do not have any consciousness. Maybe the exposures of some basic information which advertisers are bound up in collecting, such like age, gender, education background, profession and hobbies, are not a big deal for normal person. But, the contacting behavior to internet and mobile devices, which is completely different from traditional media, is always presenting the features with more individualization. The family members or some other related people are always listen to the radio or watching the television together, but surfing the internet via computer or mobile devices is always an individual behavior. That means privacy is more important for the users of internet computer and mobile devices. Meanwhile, audiences of internet media are also have the feature of anonymity, so they may expose some sensitive information, like sexual preference, special hobbies and viewpoint of politics, religions or nationalities, when they access the internet. The exposures of this kind of information may get them into big troubles.

With the development of society, especially the establishment of information society, the problems of individual privacy in public sphere cause the anxiousness of all the people day by day. In the focus of criticism, public and private sphere, which blended tightly together, cannot be split into two single parts simply. The gathering of private sphere makes the important part of public sphere. For the framing of private sphere cored by protection of individual privacy, destruction made by the maturity of data analysis technology fundamentally affects the framing of public sphere.

Nowadays, digital technology is highly developed. Popularization of mobile devices with cloud computing technology and benefit forced advertisers with the commercial logic make the collecting, storing, analyzing and spreading of the information very easy. Collecting and analyzing the information with advanced technology may still make the new threats to the individual privacy although they have existed in the public sphere and been permitted to share. The classifying and analyzing to the fragmentized sharing information which scatter in different part of public sphere can still reveal many aspects of people’s life, even approaching the privacy of people [10].

In the research of privacy, there is a famous story. Once in a party, someone asked priest whether he heard some special stories in the confessionary. The priest said his first confessor came for a murdering. A few minutes later, an elegant gentleman joined the party and presented his compliments to the priest warmly. When someone asked him how he knew the priest, he said that he was the first confessor of this priest [14]. Obviously, people got the gentleman’s information of privacy if they connect the words of priest and gentleman.

Although the story tells a coincidence, collecting and analyzing of users’ individual information, which is the theoretical and technological base of targeting advertising, is worthy to celebrate for advertisers. The crisis of privacy along with this kind of collecting and analyzing has become the problem of framing public sphere. Privacy is a complicated system of specification, expectation and aspiration. It is far beyond the simple cognition that you have no individual privacy if you are standing in public sphere (Solove, 2007).

Helen Nissenbaum detailedly described the forming process of privacy problems in public sphere of information society by giving examples. In public area, maybe every movement of everyone’s daily life has been the supervisory objective. People’s information are collected, stored, analyzed and shared some time when they communicated with retailers, post offices, medical services, children’s care center and even beauty salon. Their locations, distinguishing features and almost all the important events are recorded by the federal, state and local government with due diligence, including birth, marriage, divorce, property, driver’s license, vehicle registration, violating driving, bearing and death. You can lock people’s name, address and the number of telephone, credit card, social security, and passport and so on. People are described out in detail by the data of their age, hair color, eye color, height, eyesight, post and online purchasing, credit card, travel, working experience, renting experience, real estate transaction, address changing, number of kids, even subscription of magazines. This can be enumerated infinitely [3].

Based on this, we found that the protection of individual privacy in public sphere has become the realistic and objective demand. From the ethical point of view, the reasons of protecting privacy in public sphere are similar to the reason of protecting the traditional privacy, because the values, which have been in danger of invasion to secret area, are also in danger of so many kinds of public supervision. These values are various, including individual values such as autonomy, freedom, individuality, abilities of forming and maintaining consanguinities, mental health, creation and personal growth; and social values such as free and democratic society [10]. So, the harm of targeted advertising, from the huge information collecting and analyzing system to the
individual privacy, has been affected on public sphere.

At the same time of analyzing the effect of targeted advertising in framing public sphere, we have to admit that, with the highly developed economic and technology, the existence and development of online targeted advertising mean so much for the demand of advertiser and commercial logic, even for the demand of products’ information for normal people in this commercial community. How can we find a balance between commercial logic and framing of public sphere? This has been an important issue in front of many sociologists and advertising practitioners.

Many scholars and advertising practitioners have given some advices of solving the problems. Some scholars advise that there should be a behavior tracking switch in the browser. When the switch is turned on, the behavior of surfing can be tracked and the advertisement can be delivered. Of course, the users could turn it off when they don’t want anybody knowing what he/she does on internet and get the advertising information. Behavior information data also could be entirely opened to all the audiences and allow them delete the information of theirs. For collector and analyzer, some information, like sexual preference, race, religion or other sensitive and private information, can be ignored in the process of establishing and maintaining of users’ information model to protect privacy. On the level of information acceptance of audiences, the media, which may be contacted by the targeted audiences inititatively, can be considered. Most of the people don’t like the information which comes out automatically and is accepted passively without any choice. But the situation is completely different when they search the information inititively. For example, if the products advertisements come out when the audiences browse the website of amazon.com or ebay.com, they may click the link and look for more details. But if it appears when the audiences browse the news or play games, what the advertisement lead out will just be negative influences.

**Flourish of Consumerism: Online Targeted Advertising Under the Focus of Cultural Study**

Commodity circulation and value creation play a very important role in the development of human society. Well-developed commercial system will make an infinite acceleration for the development of productivity. In the commercial system, marketing is the segment with typical significance and it is one of the basic levels of making commodity circulation and commercial system efficiently functioning. In the concept of marketing, advertisement takes an important part of being the bridge in information communications. With this significance, online targeted advertising, which can make a maximization of advertising effect, has the extraordinary meaning.

However, the flourish of consumerism is the inexorable outcome of development of commercial system. Consumerism is a social and economic order and ideology that encourages the purchase of goods and services in ever-greater amounts. In the criticism research, the points of cultural study on consumerism are representative. Cultural study, combined with sociology, literature theory, media study and cultural anthropology, put the attention on cultural phenomenon in the industrial society. Cultural study researchers always focus on how a phenomenon connects with ideology, race, gender or social class [11].

From the view of cultural study, consumerism is considered as an activity form of gaining joviality. It is one of the projects that people dispose the relationship of products and person under the precondition of material abundance. The word of consume is not only the concept of demand and satisfaction to products in the theory of traditional political economy, but also the relationship between person and products. Jean Baudrillard, in his work *The Consumer Society: Myths and Structures*, considered that consumption structured the internal logic of capitalism society, including the point of that everyone is equal in front of commodity consumption; consumption is reflected in not only the substance, but also the cultural meaning; consumption represents individual status; the things we consumed is not the use value of products and services, but the meaning of symbolism (Baudrillard, 1970).

The consumption idea has been unconsciously influenced by the consciousness of consumerism culture. This makes a group of people who have a certain ability of consuming turning their consumerism value reflecting in the behavior of purchasing. But the people who cannot afford high level of consumption also have some tendency of consumerism. Conceptional consumerism means person cannot afford high level of consumption because of the limitation of economic condition but he/she chase or imitate the lifestyle of consumerism, even pursuing the mental or ideal consumption beyond the ability of consuming or depress the satisfaction of other basic demand.

The youth groups in the city are the main receivers of conceptional consumerism. They ideally agree with the value orientation and lifestyle of consumerism, and advocate extravagant life and so called individuality. They always connect luxury brand with refined taste and high consumption with maverick life. Coincidentally, in China and some developing countries such as China (even some developed countries), the target-consumers of online advertising are these groups of youth, who are the main users of internet and mobile devices in these countries. According to mass of news report, we can find that many young people, who earn not so much, always buy some fashionable products with credit cards, no matter it is useful or not. Even the middle class in some developed countries cannot afford these products. Therefore, what we see is that traditional concept of frugality is replacing by the concept of proper luxury and overdraft. But under the frame of traditional culture and system of active institution, it is totally different from the consumption view of zero deposit and high-range overdraft. This is a new consciousness of consumer culture, which is different from both traditional idea and western consumption concept.

No matter advertisers or sociologists should have to envisage this problem. How can we avoid excessive consumerism make an
undesirable influence to the social culture? We consider that, besides improving advertisers’ awareness of social responsibility, supervision of social institution and overall quality of consumers, keeping the quantity and quality of advertising information delivering with a certain balance may be a better choice.

For advertisers, the most important thing is finding the exact consumers. This can tremendously save the cost of delivering and make the maximization of effects. The concept of exact means not only the group of people with purchasing desire, but also the ability. Making the vehicle brand as an example, it doesn’t matter they can afford or not, the zeal of automobile amateurs to Ferrari and Lamborghini are all the same, but the advertisement of these brands cannot make an equal effect to all these people. Oppositely, some people may overdraw their credit cards, even do something illegal, to make their dream into fact. This dream is the thing that advertiser create.

As a result, we consider, to avoid the flourish of consumerism, more attention should be paid on the analysis of purchasing ability of single consumers and deliver the advertisement as their actual demand in order to save the cost of and make the maximization of effects when we do the online targeted advertising delivering.

The Contradiction Between Advertising Demands of Vulnerable Groups and Technical Barrier: Online Targeted Advertising Under the Focus of Political Economy of Communications
Advertisement is the basic reflection of commodity logic under the capitalism economic system. In every section of economy, advertisement takes an important function of information spreading and exchanging. Online targeted advertising, as the most effective and efficient form, has a very positive meaning no matter for producers or consumers.

Therefore, lots of researches manifest that high developed commercial society cannot always be positive to everyone’s life. Obviously, as the advertisers, who master a mint of money and other material force, will freely spread the thought of their own by controlling the speaking right of mass media. This kind of controlling will influence every aspect of politics, economics and culture of the society. The research of political economy of communications in criticism likes discussing this kind of problems more. The theory of political economy of communications is the typical focus of criticism research. The Critical School is the intellectual combination of the Frankfurt School with the tendency of Marxism and social research [8]. Starting with the research of Fascism’s rising, especially the history of radio and television being used by Hitler as propaganda tools, the Frankfurt School rethought and criticized the impact to politics and culture from the combination of communication industry and mass culture under the system of capitalism. Different from traditional Empirical School, which researches and analyzes the developing, operating and changing of media in a relatively closed environment, political economy of communications considers the research of communications have to be in an integrated environment of society because communicating phenomenon ineluctably has a close relationship with social political and economic system.

Political economy of communications mainly focuses on social change and historical transformation. Commercialization, spatialization and structuralization are the main research path of it. Commercialization is process of transforming use value into exchange value. It makes following effects to the communications: first, communicating process and technology make a positive effect to the process of commercialization; second, commercialization process has been infiltrated into the process and system of communications and influence to communicating practice. Then, the globalization of media products and collectivization of communicating industry make the communications spatialized. Spatialization makes communicating technology taking a core position. Structuralization means the forming process by social dynamic forces. More specifically, even though structuralization is the media which is needed in framing process, it is still accomplished by those dynamic forces. The results of structuralization are the establishment of social relationship and power, around the issues as class, gender, race and social movement, etc [15].

The delivery of online targeted advertising, to a great extent, represents the relative aspects which can affect social relationship and power in the capitalism commercial logic. It is mainly reflected in following two levels: First, internet is born with high-tech attributes. Technical barrier caused by it cannot be ignored. Technical barrier may not be the problem in developed countries, but it is ubiquitous in China and many developing countries. The people who can use computer and mobile devices skillfully are always the group with at least middle level of education and knowledge. The delivery of online targeted advertising based on the internet accessing behavior data analysis of these groups of people will certainly ignore the advertising information demand of many vulnerable groups, which seldom use internet because of lower education level. Deeply, appearance of vulnerable groups in developing countries is caused by the imbalance of education resources, which is made by imbalances of economic development. The issue of advertising demand will make this imbalance worse, and finally, it will affect every aspect of social culture.

Second, the audiences of online advertisement, which separates by technical barrier (including price barrier) from the mass, are always the persons with high education, high salary and high social position. But it doesn’t mean that normal people and vulnerable groups cannot be brought into the contact with internet and mobile devices. However, if the advertising delivery, which focuses on the three-high persons mentioned above, influences the normal people and vulnerable groups, it may not get any effect from them. Although this kind of effect could reach the level of “changing attitude”, the purchasing activity still doesn’t happen because of the purchasing power. But, it is hard to observe the cultural influences which could work on those people. If the advertising works on a poor people without positive thought of value, it may bring a strong negative effect to development of social economy and culture.
From Economy to Culture: Online Targeted Advertising and Cultural Imperialism

Besides the influence researching to politics, economy and culture in one society, criticism also analyzes the cross-border and cross-social cultural phenomenon. The most famous theory of them is cultural imperialism. Cultural imperialism could be defined as one country, rely on the advantages of its culture, exploits and occupies the global market of culture. These countries keep their culture in leading position in the world by their advanced science and technology and developed national education.

Cultural imperialism has two main targets. One is economical, the other is political. Economically, it is a market exploration for their cultural products. Politically, it is the establishment of hegemony by remodeling public awareness. The export of entertaining products is the most important source of capital accumulation, and also the method of replacing the export of manufacturing in globe. Cultural imperialism separates people from their traditional culture and unity, replaces by a kind of demand which is made by the mass media and baffling with waves of propagandization.

Online targeted advertising is also deeply seared by cultural imperialism. On the level of advertising information communication, western product advertising information, which is preponderant no matter on quantity or popularity, outdistance far away from domestic brands in most of developing countries in the area of online targeted advertising. Moreover, in technic and channels of communication, in spite of the cultural differences, the media in developing countries can still not struggle against western mighty network media and mobile devices. No matter windows or Mac OS, android or IOS, western products firmly occupy unshakable dominating and monopoly positions. Essentially, originating from developed capitalism countries, thought of online targeted advertising itself is the base of commercial logic and social culture.

Objectively, it is very important of the development of advertising industry. And, it doesn’t mean that this development does bring about the invasion of cultural imperialism. The invasion of mighty culture always appears in the advertising delivery of a few transnational enterprises or global brands. But, along with the economic globalization, cultural invasion will show a great power and influence. Nowadays, we find that Coca-Cola, McDonald’s and Burger King have changed cuisine culture of China which is used to core with rice and noodles and this may change the consumption view of Chinese step by step.

In order to solve this problem, an efficient social supervision system seems to be very important. By moderating guidance to advertising information communications, a benignant media environment could be established and the indigenous cultures can be reconstructed. Only a strong domestic culture system which can contend against the mighty culture of developed countries will fundamentally avoid the invasion of cultural imperialism.

CONCLUSION

Online targeted advertising, as the most concerned form by society, its connotation and extension are widely studied by many researchers, and effect researches are paid much attention by economists, psychologists, sociologists and scholars of communications. As the accurate delivery of advertising contents based on the analysis of consumer’s hobbies, demands and tendencies, the advertising effects are conspicuous. At the same time, along with the maturity of concept and technic of CLOUD, more accurate delivery of Online targeted advertising will be supported by more comprehensive and precise data analysis.

Different from the research by most of the economists and communication scholars of criticism, this research did a calm thinking from the other aspect to online targeted advertising from the view of criticism. Online targeted advertising enhances the effect of advertisement and acquires more benefits but it also brings many social problems, such as destruction of individual privacy protection, flourish of consumerism and information surplus. All these may introduce an indeterminate influence to the social politics, economic, culture and structuring and developing of public sphere. Even more, the high advanced advertising system, which is based on well-developed commercial system and advanced science and technology, will bring a new wave of invasion by cultural imperialism. Therefore, this research expounds the protection of individual privacy from the focus of public sphere constructing, the advantages and disadvantages of consumerism from the focus of cultural study, the construction of political, economic and cultural system in benign society from the focus of Political Economy of Communication and at last the related issues of cross-border economic developing and transcultural exchange from the focus of cultural imperialism. We hope this research can cause the deep consideration of scholars on negative influences of online targeted advertising. The construction of social culture should be paid more attention while maximizing the effect and benefits of online targeted advertising. The balance of commercial logic and cultural logic is the balance of economic benefit and social benefit.

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FROM BIG DATA TO KNOWLEDGE – GOOD PRACTICES FROM INDUSTRY

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ABSTRACT
Recent advancements in data gathering technologies have led to the rise of a large amount of data through which useful insights and ideas can be derived. These data sets are typically too large to process using traditional data processing tools and applications and thus known in the popular press as ‘big data’. It is essential to extract the hidden meanings in the available data sets by aggregating big data into knowledge, which may then positively contribute to decision making. One way to engage in data-driven strategy is to gather contextual relevant data on specific customers, products, and situations, and determine optimised offerings that are most appealing to the target customers based on sound analytics. Corporations around the world have been increasingly applying analytics, tools and technologies to capture, manage and process such data, and derive value out of the huge volumes of data generated by individuals. The detailed intelligence on consumer behaviour, user patterns and other hidden knowledge that was not possible to derive via traditional means could now be used to facilitate important business processes such as real-time control, and demand forecasting. The aim of our research is to understand and analyse the significance and impact of big data in today’s industrial environment and identify the good practices that can help us derive useful knowledge out of this wealth of information based on content analysis of 34 firms that have initiated big data analytical projects. Our descriptive and network analysis shows that the goals of a big data initiative are extensible and highlighted the importance of data representation. We also find the data analytical techniques adopted are heavily dependent on the project goals.

Keywords: Big data, analytical techniques, data-type, data-spectrum, case-study.

INTRODUCTION
Development in technologies and increase in interactions among business, consumers and suppliers have resulted in generation of vast amounts of information from which useful insights can be derived almost in real time. This occurrence is popularly known as the big data revolution [4]. Big data is not only large quantities of data sets, but information that possess characteristics like variety, velocity and value. It can be static in the form of historical information or may even evolve in real-time. Big data analytics have become increasingly important in both the academic and the business communities over the past two decades. Industry reports have highlighted this significant development. Based on a survey of over 4,000 information technology (IT) professionals from 93 countries and 25 industries, the IBM Tech Trends Report [17] identified business analytics as one of the four major technology trends in the 2010s. In another survey with 930 respondents from across the globe on the current state of business analytics within organizations by Bloomberg Businessweek Research Services [3], 97% of companies with revenues exceeding $100 million were found to use some form of business analytics, up from 90% in 2009. Big data analytics has been a fast growing market. According to the International Data Corporation (IDC), the global revenue of major players involved in big data grew by 35% to €6.1 billion in 2012 and is expected to continue rising at a similar rate until 2016 [18]. The Economist maintains that, “In recent years, Oracle, IBM, Microsoft and SAP have spent more than €11.3 billion on buying software firms specializing in data management and analytics. This industry is estimated to be worth more than €65 billion and growing at almost 10% a year, roughly twice as fast as the software business as a whole” [11]. Researchers have undertaken extensive analysis on the role of data in promoting innovation, digital literacy, economic growth and well-being [28].

The opportunities associated with data analytics in organizations have generated significant interest, which is often in the domains of techniques, technologies, systems, practices, methodologies and applications that analyse various data to help an enterprise better understand its business and market and make critical decisions [10]. Application of big data analytical tools can be found across a wide range of industries including healthcare, manufacturing, retail, market intelligence, e-government and security.

Not all organizations were embracing data-driven decision making, but when adopted, big data analytics can improve firm performance dramatically. Across the analyses conducted by McAfee and Brynjolfsson [23], they found that the more companies characterized themselves as data-driven, the better they performed on objective measures of financial and operational results. In particular, companies in the top third of their industry with data-driven decision making were 5% more productive and 6% more profitable than their competitors on average, after accounting for the variance contributed by labour, capital, outsourced services, and traditional ICT investment. The impact was statistically significant and economically important.

While there is little doubt on the impact that deriving knowledge out of big data can have on industry innovation and decision making, there are also many challenges that have been identified. In spite of the well documented rise of the data...
revolution, many businesses are yet to realign their processes to make the best of this data driven environment. For example, Isik, Jones and Sidorova [19] suggest that technological capabilities such as data quality, user access and the integration of business intelligence with other systems are necessary for its success. Ross [26] and Sharma & Bhattacharya [27] have pointed out that most companies not only fail at doing a good job with the existing information, but also do not know how to manage, analyse and translate it into their own knowledge. In order to develop companies’ competencies, they first need to learn how to use the data already embedded in their core operating systems. Until a company learns how to use data and analysis to support its operation decisions, it will not be in a position to benefit from big data [26]. Another survey of more than 3000 executives suggested that data and the relating techniques of storage and analysis were not the biggest issue. Instead, what exactly is needed from the data -- the management goal -- is the biggest challenges to set [21]. To help the industries and the public sectors translate data into knowledge, there is substantial work needed to be done in the academic domain. In an effort to help organisations understand how to perform big data analytics, transform data into actionable knowledge, and develop the ability to benchmark effectively, we aggregate the analysis of 34 cases of big data solutions in various industries in order to distil “common good practices” on its effective application using content analysis.

The remainder of the paper is organized as follows. The next section provides a review of big data analytics. Particularly, we discuss the definition, the various techniques and the applications in various industries, highlighting its many challenges and opportunities. Subsequently, we propose an empirical study that aggregate the content analysis 34 cases of big data solutions in various industries. We then describe the data coding, data analysis and discuss the results. Conclusions and future research are given in the last section.

LITERATURE REVIEW

Big Data Analytics
In the current research, we adopt the definition of big data as "data sets whose size is beyond the ability of typical database software tools to capture, store, manage, and analyse" [22]. The transformative process from big data to knowledge varies by sector and even practitioner, according to the kind of tools available and the sizes of dataset achieved in the particular industry [13]. Overall, big data in different applications range from a few terabytes to thousands of petabytes or even zettabytes. The amount of data has been exponentially growing in the recent years. During 2012, around 2.5 exabytes of data were generated daily, and the number is doubling each 40 months [23]. Data is available and created everywhere, in each department, each company, each industry, and each economy. However, big data is not only about the sheer volume. Two other significant features have been highlighted including velocity and variety [19]. The speed of data creation is a key factor in data generation, especially in channels such as online social network platforms, global position system (GPS), and real-time transaction tracking. With the real-time information, it is possible for an organization to make more accurate decisions. Another key factor in big data is the variety of the data generated. Compared with traditional relational dataset, these new data usually comes in as various forms and are unstructured, which makes them not possible to be organized in traditional relational database management system (RDBMS) databases. This new trend in decision support is evocative of what we saw in 1990s with the emergence of data mining; with the new emphasis being on data with a large number of dimensions and much higher complexity [4]. As big data is very different from traditional data, new technologies and techniques are required to serve the purpose of storage, indexing and analysis. Big Data analytics refers to technologies that carry out data mining and statistical analysis. These techniques rely on relational Database Management Systems (DBMS), data warehousing, extracting transforming and loading, Online Analytical Processing and Business Process Management [5].

From Big Data to Knowledge
Application of big data analytics tools can be found across a wide range of industries including healthcare, manufacturing, retail, utilities and public sector. On the other hand, financial giants like the Citigroup and GE Ventures have invested in big data startups like Ayasdi to explore the possibilities arising out of processing big data [20]. Big data has found application in defence research and the power sector too [16, 30]. In the following sections, we review the impact of Big Data analytics on organisations in the different industries.

E-Commerce
Arguably, e-commerce communities have been the pioneers in generating Big Data. E-commerce giants such as Amazon and eBay have lead recent surge of web analytics use. Social media platforms such as Facebook and Twitter have also proved to be a gold mine of Big Data on the internet. Web 2.0 content that is user-generated on online platforms such as forums, social media, and crowd-sourcing frameworks allows practitioners to access the views of customers, employees, investors, and media [12, 25]. In today’s digital world, e-commerce systems collect data that are less structured than that of transaction records, and often includes data of consumer behavioural information. With such data, there comes a need for new analytical techniques, and some of such techniques include association rule mining, database segmentation and clustering, anomaly detection and graphmining [1].

Government
Government and political processes are becoming more transparent in today’s world, and the participation of the people online has allowed great opportunity for Governmental organisations to tap into the growing big data online. Social
networking sites have proven to be a great ground for opinion mining and analysis, which can then support online political participation, forums analysis, e-government service delivery and process accountability [7, 9].

Healthcare
Patient points of contact and web-based communities have driven the amount of Big Data available on the internet currently. However, Gelfand [14] identified problems posed with extracting data from such databases such as regulations from the Institutional Review Board (IRB) due to privacy concerns. Additionally, its potential has not been fully taken advantage of also due to the lack of scalable analytical methods or computational platforms [24]. Two main sources of such data are genomics-driven data such as genotyping and sequencing, and payer-provider data which include electronic health and insurance records, prescriptions and customer feedback [24]. The potential of Big Data in the healthcare sector can help clinical decision making as well as building up vast knowledge bases for the several areas of healthcare [8, 29].

Security and Public Safety
Since the tragic events of September 11, 2001, security research has gained much attention, especially given the increasing dependency of business and our global society on digital enablement. Facing the critical missions of international security and various data and technical challenges, the need to develop the science of “security informatics” was recognized, with its main objective being the development of advanced information technologies, systems, algorithms, and databases for security related applications, through an integrated technological, organizational, and policy-based approach [6]. Table 1 summarizes these promising impacts and applications of Big Data analytics in the various industries.

<table>
<thead>
<tr>
<th>E-Commerce</th>
<th>E-Government</th>
<th>Healthcare</th>
<th>Security</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Recommender</strong> systems</td>
<td>Ubiquitous government services</td>
<td>Human and plant genomics</td>
<td>Crime analysis</td>
</tr>
<tr>
<td>Social media monitoring and analysis</td>
<td>Equal access and public services</td>
<td>Healthcare decision support</td>
<td>Computational criminology</td>
</tr>
<tr>
<td>Crowd-sourcing systems</td>
<td>Citizen engagement and participation</td>
<td>Patient community analysis</td>
<td>Terrorism informatics</td>
</tr>
<tr>
<td>Social and virtual games</td>
<td>Political campaign and e-polling</td>
<td></td>
<td>Open-source intelligence</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Cyber security</td>
</tr>
</tbody>
</table>

METHOD
Data Collection
Based on case-studies discussed in academic sources, trade journals and industry white papers, we selected a total of 34 featured use cases where big data has been used to achieve various business goals. The selection of the cases is based on reported usage of big data analytics and the availability of the data. These use cases and their information have been taken from credible reliable third party sources, such as the online big data knowledge platforms like the Big Data Start-ups [2]. In addition to these single point sources of case studies, we referred to the multiple back links that were indicated in these articles and found credible sources to gather the data from. This ensures an unbiased account of the cases. For each case to be included in the sample, we collected data on the availability of company background, such as the industry, size and annual revenue etc. and big data activity was being undertaken, such as the characteristics of data and techniques and processes used based on secondary sources.

Data Coding and Analysis
Based on the unstructured nature of the data collected, we performed a content analysis on these cases to arrive on insights that help us obtain a deep understanding. To perform the content analysis, we first defined the content types that we will be focussing on. Then we apply content segregation methods to bring more structure to the data in order to identify patterns and insights. To start, we identified the background of every single use case. This involved the company name, the industry and the need for which the big data activity was being undertaken. We also researched and gathered the basic company information like annual revenue and the number of employees to understand the company background. We then looked at the characteristics of the data which was being collected, treated and analysed. Chang et al [4] in their study of paradigm shift of research methods to computational social science in the presence of big data discussed the ways in which data sets can be segregated during collection of data for analysis in a high volume, high velocity and high variety environment. They introduced the concepts of data type and data spectrum in order to better understand the environment in which we are analysing the data and the characteristics of the data. We then analysed the techniques and the tools used for each big data analysis exercise. Finally, we studied the barriers and tried to identify the insights that we could gather from each use case. The basic information can be found in Appendix A.
Thus the **content types** that we focussed on for data collection were as follows:
- Company name
- Annual revenue of the company
- Total number of employees
- Industry
- Project need
- Project start date
- Solution
- Benefit
- Data entity
- Data type
- Data spectrum
- Dominating data characteristic – Volume / Velocity / Variety
- Techniques used
- Tools used
- Barriers
- Insights

The coding of each content type was executed as follows. Annual revenue, employee count and project start date are measured by ratio scale which did not require any further segregation. Due to the incremental nature of big data projects where the projects often start with small pilot activations and then transform into major projects, the exact date of start of a project is often not specified. In these cases, we either looked at major events that signalled the start of project (eg: migration of all company data into a Hadoop cluster) or dates for which the earliest records of the project is shown.

We do note that the concept of data-type and data-spectrum has not been universally identified to segregate data sources, often these data characteristics are not mentioned in the case-studies. In these events we made our assumptions from the material available and our initial understanding. Thus the identification of data-type, data-spectrum and dominating characteristics of the data is based on our knowledge and understanding of the respective cases and data. In terms of project needs, we classified them into three broad categories: customer service, improve process and derive insight. These categories are developed based on the cases collected. The solutions and benefits have been combined into Project Outcomes, which are further segregated into four broad categories. The outcome of a typical big data project is either a product/application, reporting or visualization of data points, or an informed strategic decision. These are the three categories in which the outcomes are segregated.

To satisfactorily understand and classify data, we have followed the classification suggested by Chang et al [4] in their paper which describes data through two property types – data-type and data-spectrum. Data type is the attribute assigned to the data entity to describe it under varies environments. These types can be contextual, spatial or temporal. Contextual data is the data that is generated in context with an environment. Its data has valuable meaning only in the presence of the environment it was generated in. Spatial data is the data in which the geographical location of its activity is a crucial property. Temporal data involves time as the assisting attribute. Data spectrum is a property indicates the span of the data. They can either be micro, meso or macro-data. Micro-data has the highest level of granularity which result from technology mediated human action in social or machine settings. For instance, individual tweets from a person can be called micro-data. Meso-data have a higher level of aggregation than micro-data. Meso-data may indicate the statistics related to the tweets of a user, or an overview of all the tweets concerning a particular subject or a hash-tag. Macro-data has the highest level of aggregation. It may indicate properties of a geographical area, industry or even an economic sector. Macro data on the forest area in a country will give us an account of the ecosystem balance in the region.

For the purpose of data coding on Big data analytical techniques in the current research, we needed to use the most appropriate analysis technique categories which were broad enough to include most of the techniques in the sample and focussed enough to give us a clear direction on which techniques are to be listed under which category. For this purpose, we adapted from AT Kearney’s broad categorization of big data in their white paper big data models as summarised in Table 2 [15].

<table>
<thead>
<tr>
<th>Analytical Process Maturity</th>
<th>Segmentation analysis</th>
<th>Statistical analysis</th>
<th>Sentiment analysis</th>
<th>Simulation</th>
<th>Predictive modelling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anticipatory</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Predictive</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The coded data and data evidences are provided in the Appendix B.
RESULTS AND DISCUSSION

Our sample consists of 34 companies from a range of diverse industries and sub-sectors, including manufacturing, telecommunications, retail, healthcare, hospitality, public services, entertainment, finance, food & beverage (F&B), and so on.

The annual revenues range from US$ 224.5 million to 465 billion, with two of the companies’ annual revenues exceeding US$ 450 billion (Shell and Walmart). 50% of companies in the sample have an annual revenue that is lower than US$10 billion. The numbers of employees range from 122 to 2.2 million. About 50% of the companies have more than 45000 employees. The earliest start date of the big data analytic projects is 2001 and the latest one started in 2012. Particularly, nearly one quarter (23.5%) of the projects from the sample started in 2012, indicating that big data analytics is starting to pick up its momentum in recent years. The insights that we have derived from the data are based on the patterns identified through descriptive statistics and visualizations of the coded data. The pioneers that initiated data analytical projects prior to 2006 include Catalyst IT, Amazon, Mastercard and Time Warner Cable, all of which are the major players of their own industry. Three out of the four pioneering firms are in the information and communications technology (ICT) related industry, which might have provided them with the necessary technological infrastructure and human resources for data analytical projects.

**Project Needs and Outcomes**

![Fig 1. Number of Companies with Different Project Need](image1.png)

![Fig 2. Company – Project Need Relational Graph](image2.png)

Except for four cases (AirBnb, Aurora Healthcare, Nike+ and Rabobank), all of the other cases focus on one single project need. Out of the use-cases studied, close to half of the projects (15 cases or 44.1%) are geared towards improving the customer services (see Figure 1). Through analysis of micro data gather at every customer touch-point, the companies can equip the customer service executives with relevant information about the customers and/or provide personalized responses to the consumers. The second most popular project needs is process improvement, with 13 cases or 38.2% of the companies adopting such needs. When the data describing a complex organizational, service-delivery, manufacturing, or continuous or batch manufacturing environment are made available, modeling and simulation can empower companies in conducting "what-if" analyses under variable resource configurations, and provide optimised performance solutions to operational or other business decisions. The remaining cases use data analytics to generate general business insights. The project needs of AirBnb and Aurora Healthcare consist of both customer service and process improvements. Nike+ used the date for both customer service and deriving insights, while Rabobank used its data for both process improvement and deriving insights (see Figure 2).

![Fig 3. Number of Companies with Each Project Outcome](image3.png)

![Fig 4. Project Need–Project Outcome Network Graph](image4.png)
Although most of the projects started with a single need in mind, majority of them (70.6%) finished with multiple project outcomes. As shown in Figures 3, reporting and visualization is a dominating outcome of a big data project. Though this may seem like a direct outcome to the need for providing customer support, reporting and visualization are also used by internal teams to make sense of data that the company is harvesting. Beside reporting and visualization, decision support and providing analytical services are two other outcomes mentioned by 14 cases. Lastly, out of the 34 cases in the sample, only ten analytical projects directly benefited their products. As reflected in Figure 4, each need of a big data project is connected with multiple outcomes and vice-versa. This indicated there is no fixed outcome for a particular project need. For example, the most popular project need, customer service, is related with all four categories of project outcomes, with the strongest linkage with data reporting/visualization and products.

To summarise, while only four organisations started off with multiple needs, a majority of organisations end up with multiple outcomes. This indicates that though organisations may initiate a big data project with a limited set of goals, the projects often result in seemingly unrelated outcomes. This may stem from our previously made observation that the needs and the outcomes are cross-linked.

### Analytical Techniques, Data-Types and Data Spectrum

![Fig 5. Data-types](image1)

![Fig 6. Big data analytical techniques](image2)

Predictive modelling and statistical analysis are the most prominent analytical techniques because of their wide range of applications. Contextual data is the most commonly harvested Data-Type. This may be due to the fact that contextual data are more granular in nature and thus they may create a higher number of record sets. This increases the likelihood of big data sets being formed out of contextual data.

![Fig 7. Analysis Technique – Data Type Network Graph](image3)

![Fig 8. Data analytical Technique – Data Spectrum Network Graph](image4)

As shown in Figure 7, simulation is the only technique that was applied to a single data type – contextual data. All the other techniques were applied to multiple data types. For example, statistical analysis, segmentation analysis and predictive modelling techniques have been adopted for all three data types. Sentiment analysis was not applied on the spatial data type. In general, we may gather that big data analytical techniques are not data-type diagnostic. A similar argument may also hold when we consider data-spectrum with respect to data analytical techniques. It can be seen from Figure 8 that all analytical techniques have been applied to multiple data spectrums. In fact, techniques like predictive modelling and statistical modelling were applied to all three data spectrums: macro-, meso-, and micro-data. Segmentation analysis and sentiment analysis may not process macro-data as shown in Figure 8. Yet, the results show that they are applicable to the other two data spectrums, namely, meso- and micro-data.
CONCLUSIONS

The content analysis of the various cases has brought to our attention some network characteristics of various attributes of the big data ecosystem. To summarise, our findings have highlighted four important insights. Firstly, goals of a Big Data Initiative are extensible. Efforts to achieve a single goal in a big data initiative may lead to multiple benefits. A particular set of data can deliver many insights and this can be attributed to the fact that data is application diagnostic. For example, while Disney is using spatial data harvested from the wristband to deliver customised service to the visitors, the same data can be used by Disney to detect traffic bottlenecks. Second, Representing Processed Data is as important as Effective Analysis. One of the most common outcomes of a big data initiative is enhanced reporting and visualisation of the information that the processed data delivers. This goes to point out that no matter how sophisticated the analysis of a given data set is, it will be of little use unless the results of the analysis is appropriately represented. This puts considerable emphasis on data visualisation technologies and techniques. Third, the Big Data analytical techniques to be used are heavily dependent on project goals. Data analytical techniques to be used may also depend on the kind of data that is being treated to a certain extend. Lastly, Big Data analytics are suited to data of higher granularity and lower levels of aggregation. A majority of the big data initiatives that we have studied have made use of contextual data-type and micro-meso-data spectrum. These kinds of data have lower levels of aggregation and are suited to big data processes since the number of data records tend to be higher for these data types.

As data analytical techniques are intrinsically linked with the project goals and data that is being harvested, it is essential for companies to have a thorough understanding of the decision making scenarios and the data before proceeding to select the data analytical techniques. To realise the full potential of big data analytics, managers should harvest granular data-types that are more prominent in various business processes and apply the findings in an age of customisation and advanced analytical techniques. Third, the Big Data analytical techniques to be used are little use unless the results of the analysis is appropriately represented. This puts considerable emphasis on data visualisation techniques. These kinds of data have lower levels of aggregation and are suited to big data processes since the number of data records tend to be higher for these data types.

REFERENCES


### APPENDIX A COMPANY PROFILES

<table>
<thead>
<tr>
<th>Company Name</th>
<th>Industry</th>
<th>Data entity</th>
<th>Annual Revenue (in Millions)</th>
<th>Number of employees</th>
</tr>
</thead>
<tbody>
<tr>
<td>AirBnb</td>
<td>Online / Travel</td>
<td>Multiple</td>
<td>1,000</td>
<td>600</td>
</tr>
<tr>
<td>Amazon</td>
<td>Electronic commerce</td>
<td>User behavior</td>
<td>74,450</td>
<td>117,300</td>
</tr>
<tr>
<td>Aurora Healthcare</td>
<td>Healthcare</td>
<td>Financial data, lab data, pharmacy data, procedure data</td>
<td>4,344.5</td>
<td>25,087</td>
</tr>
<tr>
<td>Australian Open</td>
<td>Sports event</td>
<td>Plays' historical performance and social networking websites</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Catalyst IT</td>
<td>Recruiting / Technology outsourcing</td>
<td>Job applicant data, real-time process data, domain public data, interaction data</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Caesars Entertainment</td>
<td>Hospitality</td>
<td>Transaction data, customer preference data, surveillance data, insurance data</td>
<td>8,830</td>
<td>70,000</td>
</tr>
<tr>
<td>Crowd control management</td>
<td>Public services</td>
<td>local tweets; Geographical Information; smartphone broadcasts</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Disney</td>
<td>Entertainment</td>
<td>Real-time location data, transaction data, customer preferences</td>
<td>45,041</td>
<td>175,000</td>
</tr>
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<td>ESPN</td>
<td>Media / Entertainment</td>
<td>web traffic, fantasy league, game statistics,</td>
<td>10,975</td>
<td>7,000</td>
</tr>
<tr>
<td>Hertz</td>
<td>car rental</td>
<td>customer survey (website, email and other messages)</td>
<td>2,436</td>
<td>29,350</td>
</tr>
<tr>
<td>InterContinental Hotels</td>
<td>Hospitality</td>
<td>Transaction data, guest partner data,</td>
<td>1,903</td>
<td>120,000</td>
</tr>
<tr>
<td>John Deere</td>
<td>Manufacturers of agricultural machinery</td>
<td>Historical and real-time data regarding weather prediction, soil conditions, crop features and many other data sets,</td>
<td>26,005</td>
<td>55,700</td>
</tr>
<tr>
<td>Kayak</td>
<td>Online / Travel / Meta</td>
<td>Search query data, airline scheduling, availability</td>
<td>224.5</td>
<td>133</td>
</tr>
<tr>
<td>Macy’s</td>
<td>Retail</td>
<td>Customer data</td>
<td>9,170</td>
<td>175,000</td>
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<tr>
<td>Mastercard</td>
<td>Retail / Finance</td>
<td>Transaction data</td>
<td>7,391</td>
<td>8,200</td>
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<tr>
<td>Morgan Stanley</td>
<td>Finance</td>
<td>Market movements and statistics, Public &amp; social data, wire data</td>
<td>36,840</td>
<td>55,794</td>
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<td>Morgan Stanley Smith Barney (MSSB)</td>
<td>Finance</td>
<td>Market movements, social media data, industry data</td>
<td>13,423</td>
<td>17,649</td>
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<tr>
<td>Nestle</td>
<td>Food &amp; Beverage</td>
<td>Social media and online interactions regarding the brands</td>
<td>92,000</td>
<td>333,000</td>
</tr>
<tr>
<td>Nike+</td>
<td>Retail/Sports</td>
<td>Consumer input, vendor data, internal process data</td>
<td>25,300</td>
<td>44,000</td>
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<td>Nordstrom</td>
<td>Luxury retail</td>
<td>Web traffic, point-of-sale data, user data (fb fans), spending behavior</td>
<td>8,770</td>
<td>52,000</td>
</tr>
<tr>
<td>Obama Campaign</td>
<td>Election</td>
<td>everything</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Purdue University</td>
<td>Education</td>
<td>Student academic preparation, session data, past performance records</td>
<td>1,263.4</td>
<td>18,872</td>
</tr>
<tr>
<td>Rabobank</td>
<td>Finance</td>
<td>Internal data, social data, Internet data, public data</td>
<td>2,779.8</td>
<td>56,870</td>
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<td>Rolls Royce</td>
<td>engine and power systems</td>
<td>components, systems or sub-systems (pressure, temperature, speed)</td>
<td>15,505</td>
<td>55,000</td>
</tr>
<tr>
<td>Shell</td>
<td>Energy</td>
<td>sensor data, technical data</td>
<td>451,235</td>
<td>87,000</td>
</tr>
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<td>Southwest Airlines</td>
<td>Airline</td>
<td>Multiple</td>
<td>16,790</td>
<td>45,000</td>
</tr>
<tr>
<td>Spotify</td>
<td>Music</td>
<td>Music listening behavior, email response tracking</td>
<td>576</td>
<td>1,200</td>
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<tr>
<td>Time Warner Cable</td>
<td>Telecommunications</td>
<td>public data sets and local viewing</td>
<td>22,100</td>
<td>51,600</td>
</tr>
<tr>
<td>Company</td>
<td>Industry/Service</td>
<td>Data Type</td>
<td>Amount</td>
<td></td>
</tr>
<tr>
<td>------------------</td>
<td>-------------------------------------------------------</td>
<td>---------------------------------------------------------------------------</td>
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<td></td>
</tr>
<tr>
<td>T-Mobile</td>
<td>wireless network operator</td>
<td>customer data, product and service data, customer experience data, business operations data, supply chain, and network data</td>
<td>24,420</td>
<td>38,000</td>
</tr>
<tr>
<td>TomTom</td>
<td>manufacture of automotive navigation systems</td>
<td>Speed limits, new street names, blocked roads, new traffic directions and altered traffic directions, Trip information</td>
<td>1,460.4</td>
<td>3,500</td>
</tr>
<tr>
<td>Union Pacific Railroad</td>
<td>Rail transportation</td>
<td>Temperature, acoustic and visual data</td>
<td>20,926</td>
<td>45,400</td>
</tr>
<tr>
<td>US Xpress</td>
<td>Time-definite truckload service</td>
<td>petrol usages, tyres, brakes, engine operations, geo-spatial data and driver comments</td>
<td>1,540</td>
<td>10,885</td>
</tr>
<tr>
<td>Walmart</td>
<td>Retail</td>
<td>Public data, social data, transaction data</td>
<td>465,294</td>
<td>2,200,000</td>
</tr>
<tr>
<td>Zynga</td>
<td>Entertainment/online game</td>
<td>Game data, server data</td>
<td>873.3</td>
<td>2,034</td>
</tr>
</tbody>
</table>
## APPENDIX B CODED DATA AND DATA EVIDENCES

<table>
<thead>
<tr>
<th>Company Name</th>
<th>Project Start date</th>
<th>Coded project need(s)/goal(s)</th>
<th>Data evidence on project needs</th>
<th>Data-type</th>
<th>Data-spectrum</th>
<th>Volume/Velocity/Variety</th>
<th>Techniques used</th>
<th>Coded project outcome(s)</th>
<th>Data evidence on project solutions</th>
<th>Data evidence on project benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>AirBnb</td>
<td>2009</td>
<td>Improve process Customer Service</td>
<td>Optimize resource allocation &amp; sales</td>
<td>Contextual, Temporal (website optimisation)</td>
<td>Micro-data, Meso-data</td>
<td>Variety, Velocity</td>
<td>Regression analysis, predictive modeling, segmentation analysis</td>
<td>Analytic services Reporting &amp; visualization</td>
<td>Trend analysis of content and location based data</td>
<td>Optimize market rates, improve sales</td>
</tr>
<tr>
<td>Amazon</td>
<td>2003</td>
<td>Customer Service</td>
<td>Customize the webpages for customers</td>
<td>Contextual</td>
<td>Micro-data, Meso-data</td>
<td>Volume, Velocity</td>
<td>Predictive analysis, segmentation analysis</td>
<td>Reporting &amp; visualization Decision support Products &amp; applications</td>
<td>Collect all data from customers, use recommender system</td>
<td>Offer superior service, improve the relationship with customers; monitor, track and secure items</td>
</tr>
<tr>
<td>Aurora Healthcare</td>
<td>2009</td>
<td>Improve process Customer Service</td>
<td>Improve decision-making and service standard, get nationally recognized measure of the clinical performance</td>
<td>Temporal, contextual</td>
<td>Micro-data, Meso-data</td>
<td>Volume, variety</td>
<td>Pattern recognition; Predictive analysis</td>
<td>Reporting &amp; visualization</td>
<td>Created a hybrid business intelligence system combining 18 different streams of data for storage and analysis</td>
<td>Predict and improve patient outcomes and treatments; cost saving of $6mil; helping doctors to analyse the outcome and recommend different procedures</td>
</tr>
<tr>
<td>Australian Open</td>
<td>2012</td>
<td>Customer Service</td>
<td>Fans want to know all about their favourite tennis player</td>
<td>Contextual, Temporal</td>
<td>Micro-data</td>
<td>Variety, Velocity</td>
<td>Data visualisation, statistical analysis, sentiment analysis preventive scaling</td>
<td>Reporting &amp; visualization Products &amp; applications</td>
<td>Data is captured, analysed and shared in real-time on multiple platforms and multiple devices</td>
<td>Full-interaction during the events; improved data reliability and server robustness</td>
</tr>
<tr>
<td>Catalyst IT</td>
<td>2001</td>
<td>Improve process</td>
<td>Speedup candidates screening process and maintain employee</td>
<td>Spatial, contextual</td>
<td>Micro-data, Meso-data</td>
<td>Volume, Variety</td>
<td>Data mining, pattern recognition</td>
<td>Decision support</td>
<td>The company came up with an algorithms for analysing applicant based on how an obligatory survey is completed. The analysis is based on data, not perceptions.</td>
<td>Employee turnover is brought down to only half of the market average.</td>
</tr>
<tr>
<td>Ceasars Entertainment</td>
<td>2009</td>
<td>Improve process</td>
<td>Improve service standard an bring personalized guests experience; improving employee performance and satisfaction</td>
<td>Spatial, temporal</td>
<td>Micro-data</td>
<td>Volume, variety</td>
<td>Data mining, pattern recognition</td>
<td>Reporting &amp; visualization Decision support</td>
<td>Based on the Total Rewards program, guests are tracked through the journey and data were used to analyse and provide insights on their behaviour.</td>
<td>Better customer satisfaction; more efficient manpower deployment and better employee satisfaction</td>
</tr>
<tr>
<td>Crowd control management</td>
<td>2012</td>
<td>Customer Service</td>
<td>The safety among all the visitors</td>
<td>Spatial, Temporal</td>
<td>Micro-data, Meso-data</td>
<td>Volume, Variety, Velocity</td>
<td>Data mining, sensitivity analysis, information visualisation, statistical analysis</td>
<td>Reporting &amp; visualization Analytic services</td>
<td>Using three tools to monitor the real-time pictures of the situation.</td>
<td>Find emergencies happening; a real-time situational awareness overview of a complete area; control the amount of people.</td>
</tr>
<tr>
<td>Disney</td>
<td>2010</td>
<td>Customer Service</td>
<td>Understand visitors to the theme park, provide personalized</td>
<td>Spatial, Temporal</td>
<td>Micro-data</td>
<td>Volume, variety</td>
<td>Data mining, predictive analysis</td>
<td>Analytic services</td>
<td>Use wireless-tracking wristband to collect real-time data on every visitor; tied to</td>
<td>Better visitor analysis, traffic flow, personalized service</td>
</tr>
<tr>
<td>Company</td>
<td>Year</td>
<td>Name</td>
<td>Description</td>
<td>Temporal</td>
<td>Meso-data</td>
<td>Velocity</td>
<td>Insight</td>
<td>Reporting &amp; Description</td>
<td>Credit Card and Other Service Points</td>
<td>Relevant Stories and Telecasts to the User</td>
</tr>
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<td>------------------------------------------------------</td>
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<td>--------------------------------------------</td>
</tr>
<tr>
<td>ESPN</td>
<td>2012</td>
<td>Customer Service</td>
<td>Provide most relevant telecasts and news to viewers</td>
<td>Temporal</td>
<td>Meso-data</td>
<td>Velocity</td>
<td>Information visualisation, statistical analysis, sentiment analysis</td>
<td>Reporting &amp; visualization Decision support</td>
<td>Over 50 data scientists analysing real-time data to provide relevance. ESPN API</td>
<td>Relevant stories and telecasts to the user</td>
</tr>
<tr>
<td>Hertz</td>
<td>2011</td>
<td>Derive insight</td>
<td>Keep track of customer touch points a day</td>
<td>Contextual, Temporal</td>
<td>Micro-data</td>
<td>Volume</td>
<td>Sentiment analysis</td>
<td>Analytic services Reporting &amp; visualization</td>
<td>Real-time analyses on the captured unstructured data</td>
<td>Understand real-time customer's opinion, improve service and retain customers</td>
</tr>
<tr>
<td>InterContinental Hotels</td>
<td>2010</td>
<td>Improve process</td>
<td>Better understanding of overall organization's performance</td>
<td>Spatial, Temporal</td>
<td>Micro-data, Meso-data</td>
<td>Velocity, Variety</td>
<td>Operational analytics, regression and correlation analysis, predictive analytics</td>
<td>Analytic services Reporting &amp; visualization</td>
<td>Big data analysis system with more than 650 variables on unstructured and structured data.</td>
<td></td>
</tr>
<tr>
<td>John Deere</td>
<td>2012</td>
<td>Derive insight</td>
<td>Help farmers increase productivity</td>
<td>Contextual, Spatial</td>
<td>Micro-data</td>
<td>Volume, Variety, Velocity</td>
<td>Predictive analysis</td>
<td>Analytic services Reporting &amp; visualization</td>
<td>Add sensors to equipment</td>
<td>Increase the productivity and efficiency of the crops that will in the end lead to higher production and revenue.</td>
</tr>
<tr>
<td>Kayak</td>
<td>2006</td>
<td>Derive insight</td>
<td>Derive insights from aggregated data</td>
<td>Temporal</td>
<td>Meso-data</td>
<td>Volume</td>
<td>Predictive analytics, A/B testing (to improve website and user experience)</td>
<td>Reporting &amp; visualization</td>
<td>Predictive analysis and feedback measurement to provide travellers with insights</td>
<td>Offer rich user experience through data aggregation</td>
</tr>
<tr>
<td>Macy's</td>
<td>2007</td>
<td>Customer Service</td>
<td>personalized shopping experience</td>
<td>Contextual</td>
<td>Micro-data</td>
<td>Variety</td>
<td>Predictive analytics</td>
<td>Products &amp; applications Decision support Analytic services</td>
<td>Dynamic, data-driven and integrated website</td>
<td>Customized content granular pricing market strategy</td>
</tr>
<tr>
<td>Mastercard</td>
<td>2005</td>
<td>Derive insight</td>
<td>Find consumer spending patterns</td>
<td>Spatial, Temporal</td>
<td>Micro-data</td>
<td>Volume, Variety</td>
<td>Statistical analysis, Predictive analysis, Segmentation analysis</td>
<td>Reporting &amp; visualization Analytic services</td>
<td>Detailed customer segments from transaction data</td>
<td>Offer insights to tenants</td>
</tr>
<tr>
<td>Morgan Stanley</td>
<td>2011</td>
<td>Improve process</td>
<td>Traditional databases and grid computing was no longer supporting the vast data</td>
<td>Temporal, Contextual</td>
<td>Macro-data</td>
<td>Volume, Velocity</td>
<td>Statistical analysis</td>
<td>Analytic services Reporting &amp; visualization</td>
<td>Use Hadoop to store mass logs to discover problems and predict impact of events on the system</td>
<td>Hadoop helps with mission critical investment projects</td>
</tr>
<tr>
<td>Morgan Smith Barney (MSSB)</td>
<td>2010</td>
<td>Customer Service</td>
<td>Improve their recommendations for their investments in stocks, municipal bonds and fixed income</td>
<td>Temporal</td>
<td>Micro-data</td>
<td>Velocity, Variety</td>
<td>Predictive analysis</td>
<td>Decision support</td>
<td>Use of predictive analysis of big data to improve recommendations</td>
<td></td>
</tr>
<tr>
<td>Nestle</td>
<td>2006</td>
<td>Derive insight</td>
<td>Understand the brand sentiment of multiple</td>
<td>Contextual</td>
<td>Micro-data</td>
<td>Volume, Variety</td>
<td>Data visualisation, sentiment analysis</td>
<td>Reporting &amp; visualization</td>
<td>Digital acceleration team - a 24/7 monitoring center that</td>
<td>Understand the sentiment of consumers and take actions</td>
</tr>
<tr>
<td>Company</td>
<td>Year</td>
<td>Program/Initiative</td>
<td>Contextual - Process</td>
<td>Micro-data/Meso-data</td>
<td>Volume, Variety, Velocity</td>
<td>Data Mining, Predictive Analysis</td>
<td>Decision Support</td>
<td>Products &amp; Applications</td>
<td>Reporting &amp; Visualization</td>
<td>Notes/Additional Information</td>
</tr>
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</tr>
<tr>
<td>Nike+</td>
<td>2012</td>
<td>Derive insight Customer Service</td>
<td>Spatial, contextual</td>
<td>Micro-data, Meso-data</td>
<td>Volume, variety</td>
<td>Data mining, predictive analysis</td>
<td>Products &amp; applications</td>
<td>Decision support</td>
<td>Reporting &amp; Visualization</td>
<td>Gamification platform Nike+ Accelerator to encourage users to share; centralized material-for-production database for designer; open data sharing to build &quot;vendor index&quot;</td>
</tr>
<tr>
<td>Nordstrom</td>
<td>2012</td>
<td>Customer Service</td>
<td>Contextual, Spatial</td>
<td>Micro-data</td>
<td>Variety</td>
<td>Predictive analysis, data visualisation</td>
<td>Products &amp; applications</td>
<td>Analytic services</td>
<td>Cross channel inventory</td>
<td>Increase in same store sales Identify products to market</td>
</tr>
<tr>
<td>Obama Campaign</td>
<td>2007</td>
<td>Improve process</td>
<td>Spatial, Temporal, contextual</td>
<td>Micro-data, Meso-data, Macro-data</td>
<td>Volume, Variety, Velocity</td>
<td>Decision support</td>
<td>Divide campaign team into different channels; use MPP database</td>
<td>Find the influences of this campaign, find the influences of this campaign</td>
<td>Risk profile of student's academic performance could be generated as early as 2nd week of the semester, with suggested materials/solutions to help students improve. Better academic performance was observed since its implementation</td>
<td></td>
</tr>
<tr>
<td>Purdue University</td>
<td>2011</td>
<td>Improve process</td>
<td>Temporal, contextual</td>
<td>Micro-data</td>
<td>Volume, Velocity</td>
<td>Predictive modelling, data mining</td>
<td>Reporting &amp; visualization</td>
<td>Course Signal - a platform that analyses the student's behavior and academic performance based on their activities and past records.</td>
<td></td>
<td>Fast consumer analysis, real-time auto-completion of forms and feedback gathering</td>
</tr>
<tr>
<td>Rabobank</td>
<td>2006</td>
<td>Improve process Derive insight</td>
<td>Spatial, contextual</td>
<td>Micro-data, Meso-data</td>
<td>Volume, variety</td>
<td>Data mining, pattern recognition, content analysis</td>
<td>Products &amp; applications</td>
<td>Decision support</td>
<td>All engines are equipped with sensors; All minor details are sent via satellite to a computer that analyses the data.</td>
<td>Early warning; minimizes disruption and delays for customers; make engines safer and more reliable</td>
</tr>
<tr>
<td>Rolls Royce</td>
<td>2010</td>
<td>Improve process</td>
<td>Contextual</td>
<td>Micro-data</td>
<td>Velocity, Variety</td>
<td>Reporting &amp; visualization</td>
<td>Decision support</td>
<td>All engines are equipped with sensors; All minor details are sent via satellite to a computer that analyses the data.</td>
<td>Early warning; minimizes disruption and delays for customers; make engines safer and more reliable</td>
<td></td>
</tr>
<tr>
<td>Shell</td>
<td>2008</td>
<td>Improve process</td>
<td>Spatial, Temporal</td>
<td>Micro-data</td>
<td>Volume, velocity</td>
<td>Regression analysis, predictive modeling, information visualisation</td>
<td>Analytic services</td>
<td>Reporting &amp; visualization</td>
<td>With sensors laid into every well and a group of analysts working at the backend, the company could know the progress and output projection of the well.</td>
<td>3D or 4D map of the oil reservoirs; immediate visualization for analysis and reporting</td>
</tr>
<tr>
<td>Southwest Airlines</td>
<td>2008</td>
<td>Customer Service</td>
<td>Contextual</td>
<td>Micro-data</td>
<td>Variety</td>
<td>Psychographic analysis, predictive analysis</td>
<td>Analytic services</td>
<td>Psychographics using big data analytics</td>
<td>Multiple business output optimisations</td>
<td></td>
</tr>
<tr>
<td>Spotify</td>
<td>2012</td>
<td>User of data like log messages to provide</td>
<td>Contextual</td>
<td>Meso-data</td>
<td>Volume, velocity</td>
<td>Predictive analysis, A/B</td>
<td>Reporting &amp; visualization</td>
<td>An eco-system of multiple big data technologies to leverage</td>
<td>Creation of a billion dollar industry built on data</td>
<td></td>
</tr>
<tr>
<td>Company</td>
<td>Year</td>
<td>Action</td>
<td>Data Type</td>
<td>Analysis Type</td>
<td>Products &amp; Applications</td>
<td>Additional Details</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Time Warner Cable</td>
<td>2005</td>
<td>Customer Service</td>
<td>Audience metrics, Micro-data, Meso-data</td>
<td>Variety</td>
<td>Cross-platform analysis, Analytic services, Products &amp; applications</td>
<td>Combine public data sets and local viewing habits to measure user preference</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T-Mobile</td>
<td>2012</td>
<td>Derive insight</td>
<td>Contextual, Micro-data, Meso-data</td>
<td>Volume, Variety, Velocity</td>
<td>Sentiment analysis, Reporting &amp; visualization</td>
<td>Using different data zones that are connected to business objectives</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TomTom</td>
<td>2009</td>
<td>Customer Service</td>
<td>Spatial, Temporal, Micro-data</td>
<td>Volume, Variety, Velocity</td>
<td>Reporting &amp; visualization, Products &amp; applications</td>
<td>When users docked their SatNav their anonymized information was sent to TomTom.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Union Pacific Railroad</td>
<td>2011</td>
<td>Improve process</td>
<td>Temporal, Macro-data</td>
<td>Volume</td>
<td>Predictive analysis, Analytic services, Reporting &amp; visualization, Network of sensors</td>
<td>Predict train derailment weeks before it occurs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>US Xpress</td>
<td>2008</td>
<td>Improve process</td>
<td>Contextual, Spatial, Micro-data, meso-data</td>
<td>Volume, Variety, Velocity</td>
<td>Geospatial analysis, statistical analysis, Analytic services, Reporting &amp; visualization</td>
<td>On-stop: combine all different data streams into one interface</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Walmart</td>
<td>2011</td>
<td>Customer Service</td>
<td>contextual, temporal, Micro-data, meso-data</td>
<td>Volume, variety, velocity</td>
<td>content analysis, data mining, Products &amp; applications, Reporting &amp; visualization</td>
<td>In house products Social Genome and ShoppyCat could help better understand the</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zynga</td>
<td>2008</td>
<td>Derive insight</td>
<td>Spatial, contextual, Micro-data</td>
<td>Volume, velocity</td>
<td>Pattern recognition; Predictive analysis, Decision support</td>
<td>Walmart could optimize the local assortment of stores based on neighbourhoods'</td>
<td></td>
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</tr>
</tbody>
</table>

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The Fifteenth International Conference on Electronic Business, Hong Kong, December 6-10, 2015

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HOW DOES THE BUSINESS MODEL AFFECT THE CORPORATION PERFORMANCE?

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ABSTRACT
In recent years, the business model has become more and more concerned, and both the academic and business circles are aware of its importance. This paper analyzes and classifies the business model of e-commerce enterprises, as well as refines the e-commerce enterprise performance index. In this paper, the data of 22 e-commerce companies listed in the United States are collected. The classification indicators of e-commerce business model include target market, business pattern and asset structure. Through the combination of three categories of indicators, the selected 22 companies are divided into 10 categories. And the performance of e-commerce enterprises is measured by profitability indicators, operating efficiency indicators and growth potential indicators. Through the one-way ANOVA, it is found that the business model of electronic business company has caused the difference of business performance to some extent, and the influence of different dimensions of performance is also diverse.

Keywords: electronic commerce, business model, corporation performance.

INTRODUCTION
At present, many scholars are in the study of business model, the business community is also concerned about the development of it, and the research of business model and corporation performance is becoming more and more mature. However, there are few papers about the relationship between business model and corporation performance of Chinese e-commerce enterprises. Even though some domestic scholars have studied the impact of the business model of e-business performance, they almost use qualitative research methods by issuing questionnaires to some authorities, experts and business executives. Therefore, after studying the relevant literature, this paper focuses on the relationship between business model and corporation performance of Chinese e-commerce enterprises which listed in the United States, using one-way analysis of variance quantitatively analyze the impact of the business model on corporation performance in different dimensions.

LITERATURE REVIEW
The word business model first appears in 1957, but it is widely used and spread until nineties of 20th century. Business model is actually a new type of organization structure, whose purpose is to create value, and the elements of this organization interact with each other with clear-cut assignment of responsibility [5]. The value of business model is decided by the synergy of trade content, structure and management [1], and people is the main participant [8]. It is believed that business model is the transformation process of technology to economy [3], and business model is not only within the company, but the cooperation of interior and exterior [9]. Business model is used to allocate corporate resources rationally, balance the interests of various subjects in the course of operation, and create more value for the companies [7]. In the study of analyzing business model, the Bridge Model (Gray Hamel, 2000) is widely accepted, which has four modules and three connections. In addition, the Double Triangle Model [11] believes business model is the combination of different trading modes, resources and capabilities based on most stable and minimum costs.

Electronic commerce is the commercial activity taking information technology as the main tool and treating commodity exchange as the center. It is the electronicization, networking and informatization of traditional commercial activities. Different classification standards lead to different types of business models, and there have been a wide range of models of e-commerce, following three models having certain representativeness. The first one is B-webs, which full name is business webs. It has five kinds of business models based on two dimensions, named industrial chain, alliance, distribution network, network market and e-commerce sites. The second model is three-dimensional axis model (Wang Lan, 2010), which has three dimensions to describe and analyze business model, where X axis represents the horizontal value chain, Y axis represents the vertical value chain, and Z axis represents the internal value chain. And the last business model of e-commerce this paper will introduce is the octagon model (Chen Shengpeng, 2010), which has a core and three supports, inspired by the previous scholars' research and literature. It makes the use of abstract graphics to analyze factors of 9 business models.

Many literatures have studied the impact of business model on corporation performance and some empirical studies have been carried out. In one case, business models are divided into 16 types due to companies’ resources and trading rights, and then 6 correlative corporation performance indicators are chosen to be studied. In this case, all the American corporations listed between 1998—2002 are involved (Malone, 2006). The results show that the different business models do have significant difference in performance, and the degree of influence is not the same in different performance indicators.

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\* This is an extended version of an earlier paper.
It is believed that the classification of enterprise business model is related to the enterprise's own resources and business, which may affect the results of the enterprise performance [2]. Some studies encompass the enterprise operating system, from customers, supply channels, processes, and resources, finding out that business model offering more exquisite and deep-going analysis to the composition of internal elements and structure than industrial classifications [10]. Moreover, business model is one of the structural contingency factors which influence the enterprise strategy selection and utility [13]. Inspecting the matched degree between business model form and product market strategy and the contingency effects of those two to corporation performance finds that business model and strategy are two different variables affecting the performance of the enterprises, and the matched degree between the two is significant.

METHODS

The business model is ultimately to be embodied by the corporation performance. Combined with the current situation of e-commerce, and on the basis of relevant research literature, this paper builds a set of appraisal target system of business model classification indicators and corporation performance indicators, then classify the business pattern of selected e-commerce companies, and explore whether different business models will lead to differences in corporation performance, and finally make suggestions on e-commerce business model innovation.

In this paper, we study the business model and performance of e-commerce enterprises, and we choose the Chinese e-commerce companies which listed on NASDAQ and NYSE as a sample. This paper selects 22 companies as a sample study, the reason for choosing these companies is that they all have listed in the US before 2012, and have at least three years' detailed financial data report. The data involved in this paper is mainly about the relevant management and performance data of the sample enterprises. In order to guarantee the reliability of the electronic commerce listing corporations’ business model classification, the data, chiefly referring to the performance of e-commerce enterprises in the business model of the classification index, is mainly found on the Nasdaq.com and Nyse.com.

**THE IMPACT OF BUSINESS MODEL ON CORPORATION PERFORMANCE**

This paper uses one-way analysis of variance, found by R.A.Fister, also known as "F test" or "variance analysis", which can be used to test two or more samples’ mean difference whether significant or not, to find the effects of business model on corporation performance. In order to guarantee the credibility of the results, paper chooses the business models which contain at least two companies as objects of ANOVA. There are 22 companies from 8 business model categories through our study. The main content of data analysis is to find out the impact of business model on corporation performance in each dimension, for these listed e-commerce companies. The results reveal that the business model choosing is one factor of business performance difference to some extent, and business model brings different degree effects to different dimensions of performance.

CONCLUSIONS

In this study, only three of eight indicators of corporation performance are influenced significantly by business model. E-commerce industry has its particularity, concretely, only few companies can become enormous in a specific area, which is due to resource tilt and user habits. Therefore, every good listed e-commerce company has its unique characteristics, which lead itself hard to be classified. This may be the main reason for the impact of the final research results.

REFERENCES


HOW PIYO PIYO PEDDLES FROM A SMALL POND TO THE VAST SEA

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ABSTRACT

Piyo Piyo, yellow duck, from Cayman Tung Ling Industrial Co., Ltd. is not unfamiliar to those who were born in the 70’s and 80’s, merchandise and toys of the brand are their childhood memories. Tung Ling’s Piyo Piyo was found in 1988, over the years, it has over 400 retail branches around the world; however, in this Internet prospered 21st era, even an old brand, such as Tung Ling needs to use its advantages to elevate itself from competitions, especially in e-commerce field. One of the major tasks for Tung Ling is to build and develop a method for e-commerce, and the founder of the company listed this effort as one of the ten key accomplishments within the next 10 years; moreover, it will have more professionals and active discussions regarding the matter in order to thrive in web-commerce.

Key words: Web 2.0, e-commerce, mobile devices, mobile commerce, third-party payment

INTRODUCTION

Dutch artist Florentijn Hofman designed the rubber duck, which swan from Netherlands across Europe, than travel through America to Asia, people around the global were crazy about the phenomenon. When the Rubber Duck Project arrived the Hong Kong Victoria Harbour in May 2nd, 2013, the little toy known from bath tub suddenly became a widely discussed topic, and many people in Taiwan were anticipating if the rubber duck could swim to Taiwan. Finally, in September 19th, 2013 the rubber duck swam to Kaohsiung City Glory Pier, and the hive of this duckling rage crossed Taiwan. Fu-Chin Syu stood at the pier, looking at the crowd, and thinking that how can those people be so crazy about this giant rubber duck? As he was thinking for a period of time, an idea emerged out, and that is to make his yellow duck, Piyo Piyo, to swim over into the vast sea.

BACKGROUND OF TUNG LING AND PIYO PIYO

As it was 20 years ago, people in the 70’s and 80’s known Piyo Piyo as toys or gifts; in addition, Cayman Tung Ling Industrial Co., Ltd.’s yellow duck, Piyo Piyo, is not the same as Florentijn Hofman’s giant rubber duck art display. Although the appearance of the ducks are different, they both can comfort people and are adored by individuals around the world.

Yellow duck, Piyo Piyo, is a Taiwan brand for child supplies, it is successful throughout mainland China, Hong Kong and Taiwan. The company was found by Fu-Chin Syu and his wife Bao-Sia Lin in 1988, they had the idea to transform traditional merchandise by adding fashion, trendy and safety elements into gift concepts. They not only target young mothers as their customers, but also define Piyo Piyo’s brand, and bringing specialty, safety, and lovely goods to children.

Back when Tung Ling was not relatively a well-known company, an American customer placed a huge amount of order, but it ran away without any notices, and it almost cost the entire company.

Tung Ling went public in 2010, “I have suffered for 20 years!” Mr. Syu noted. How the always-serious founder did come out with the idea of making the cute little duckling? It was inspired by an order from Boston U.S.A., which were animal shaped toys to play with while taking a bath, and that gave Syu the inspiration to design animal characters.

OPPORTUNITY OF ENTITY OPERATION AND OWN BRAND MANAGEMENT

In the 80’s, most of the Taiwan economies were exports, when Mr. Syu first started up his company in 1988, it went bankrupt due to a significant uncollectable account. Furthermore, the merchandise did not have distinctive characteristic, and those were difficult to be sold in the market, with this experience, he came to realized that if a company wants sustainable developments and expansions, it must develop its own brand.

Image is crucial to a brand, after doing market researches, it was found that duck, frog, elephant, antelope and dog are five most popular animals among children. The design team discussed over those animals, that elephant was used by a competitor, so it was out the table. On the other hand, duck made the team feel that it is cute, fluffy, and gives a comfort feeling; moreover, the company has had many orders of duck designs over the years, and so the design of the yellow duck was born (Figure 1). The name Piyo Piyo was named after duck’s voice in Mandarin.
With Piyo Piyo this own brand, the company has produced over 5,000 items, including various stuffed animal, bag pack, carrying bag, mug, plate, wooden goods and household accessories (Figure 2). Tung Ling has grew from a 20 people trading company to 1,500 employee multi-country group. In the 80’s, as one of the four Asian tigers, Taiwan’s economic, importing and exporting were booming. Tung Ling was established in 1988, then entered China market and set up a Shanghai Tung Ling in 2002. It also has over 400 retail branches in China, Hong Kong and Taiwan. As the company expanded its business further to Los Angeles U.S.A., With Mr. Syu’s success and past failure experiences as the foundation stone, Tung Ling can now challenge itself in a different field of business.
JOIN THE BATTLEFIELD OVER THE INTERNET

As time moving forward, in the last few years of 2010’s, e-commerce is likely to exceed 50% of the retail market. E-commerce is a vital factor for traditional companies to be transformed, based on a research from the Institute for Information Industry, Taiwan’s e-commerce industry has the opportunity to break a trillion benchmark in 2015. Alibaba Group broke the U.S. IPO record in 2014, and e-commerce related topics were widely discussed. Tung Ling and Piyo Piyo stand to the challenge and they are bringing themselves to another peak of business.

What troubles Mr. Syu the most is that Tung Ling can either choose to sale its merchandise on existing shopping platform, such as Taiwan’s Yahoo, PChome, Ruten, ASIA, Pingle and etc., China’s Taobao, Tmall, Yintai, JD, Dangdang, Yixun, Yhd, Tencent, Feiniu and etc. By utilizing those platforms Piyo Piyo has had sufficient exposures without a great deal of advertisement costs, and also gained experiences in e-commerce. In 2014, the China November 11th shopping fest generated NTD 162 million for the company, which is historic high comparing to October’s NTD 153 million, a 6.42% growth (Table 1).

Table 1. Annual Report of Cayman Tung Ling Industrial Co., Ltd. 2009 to 2013

<table>
<thead>
<tr>
<th>Item</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012 First 3 seasons</th>
<th>2013 First 3 seasons</th>
<th>2012 and 2013 Growth Rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net Income</td>
<td>774,443</td>
<td>954,489</td>
<td>1,116,388</td>
<td>1,089,486</td>
<td>1,115,680</td>
<td>2.40%</td>
</tr>
<tr>
<td>Gross</td>
<td>391,021</td>
<td>540,154</td>
<td>628,555</td>
<td>687,684</td>
<td>717,585</td>
<td>4.35%</td>
</tr>
<tr>
<td>Gross Margin</td>
<td>50%</td>
<td>57%</td>
<td>56%</td>
<td>63.12%</td>
<td>64.32%</td>
<td>1.90%</td>
</tr>
<tr>
<td>Profit</td>
<td>106,943</td>
<td>174,823</td>
<td>156,792</td>
<td>140,349</td>
<td>120,748</td>
<td>-13.97%</td>
</tr>
<tr>
<td>Net income before tax</td>
<td>101,361</td>
<td>170,316</td>
<td>158,912</td>
<td>137,991</td>
<td>135,992</td>
<td>-1.45%</td>
</tr>
<tr>
<td>Net income after tax</td>
<td>64,634</td>
<td>125,157</td>
<td>104,927</td>
<td>91,750</td>
<td>89,094</td>
<td>-2.89%</td>
</tr>
<tr>
<td>EPS</td>
<td></td>
<td></td>
<td></td>
<td>2.89</td>
<td>2.81</td>
<td>-2.77%</td>
</tr>
</tbody>
</table>

Based on Chart 1, from 2009 to 2010 the income was growing, at that period of time, Piyo Piyo has not involved in e-commerce, which means retail branches has taken a great part of business effectively. However, in 2011, its income did not make to the next level but declined. Tung Ling has found that customers have the tendency to shop online rather than depending on retail stores. Therefore, Mr. Syu assembled his staff and also hired new specialized employees for a new e-commerce division. Finally, in 2012 and 2013, with profits from both retail and online stores, the company has seen ascending in income.

LIMITATIONS OF DOING BUSINESS ON SHOPPING PLATFORMS

One of the simplest way to get into e-commerce is by doing business on shopping platforms. Most of the well-known platforms provide free posting and free transaction fee services at the beginning, but after a while, sellers will receive a notice that the platform provider is going to charge NTD 10 per each posting. When the virtual mall becomes more mature, sellers will receive another notice regarding 10% to 20% transaction fee. Nevertheless, Tung Ling or Piyo Piyo is unable to generate more customer flow and revenue, and most importantly, the company is unable to make marketing decisions freely, everything has to be checked with platform providers. There are also customer service issues, many problems were not able to be solved due to miscommunication and indirect services.

To address this issue, Mr. Syu called up Tung Ling’s senior managers to discuss what and how the company can do to future e-commerce operations. John, the CEO from U.S.A., has thoughts about how Tung Ling can operate in e-commerce, and he knows how the whole company function very well. Syu decided to list e-commerce project as a critical part of company development and transformation in the next 5 to 10 year, and appointed John as the executor. As John was thinking ways to approach e-commerce, he attended a class at National Taiwan Normal University and met an instructor Mr. Tsao. After talking to Mr. Tsao, John has more clear ideas and thoughts about what to do next, and he invited Mr. Tsao as the consultant of this project. Tsao suggested John to discuss 3 main models, understanding Tung Ling’s strength and weaknesses, then develop the...
most beneficial strategy for the company.

CHOSIC ES UNDER MATURE E-COMMERCE ENVIRONMENT

Mr. Tsao and Mr. Syu further discussed what their ideas are. “I would like to establish an e-mall for children and moms, since there is no such website at this moment in Taiwan, the growth can be huge. It should be creative and also an integrated website,” stated Mr. Syu. Mr. Tsao reminded him that a new method of e-commerce always has its own ricks, but Syu does not afraid of failures, he wants to be different and be top of the industry, and he can even give one more attempt if something went wrong.

After understanding what Mr. Syu has in mind, Mr. Tsao analyzed Tung Ling’s strength and weaknesses in e-commerce, results are as follows:

**Portal Website**

BabyHome and MamiBuy has information and numerous articles for consumers to look up, it is quite a mature market, if Tung Ling was to build up all those information, it would take time and huge amount of labor.

**B2C Method**

It is quite competitive since there are services like delivery within 24 hours and even 6 hours, with the consideration of building warehouses, and also competitions from retail stores, it can be challenging to achieve.

**C2C Method**

Ruten Auction and Yahoo Auction are the major providers in Taiwan, whereas Taobao in China, if Tung Ling was to operate this method, it would be hard to see results in short amount of time, and the investment for IT infrastructure and customer service are high.

**B2B2C Method**

PChome and Yahoo are both successful cases, and both of them are large portals, which means they do not usually engaged deeply in each section and items; however, it can be a great opportunity for Tung Ling to activate an e-mall for children and moms, and integrate with retail stores and dealers; in addition, all of them can be benefited from the website, and one of the goals is to become the website with the most merchandise.

DECISION MAKING

With the analysis from Mr. Tsao, Mr. Syu, John, and other senior managers were discussing about which model to implement. Many voices were popping out, some consider that Tung Ling is a listed company, it should do better than just displaying information, and deeply in each section and items; however, it can be a great opportunity for Tung Ling to activate an e-mall for children and moms, and integrate with retail stores and dealers; in addition, all of them can be benefited from the website, and one of the goals is to become the website with the most merchandise.

**MAKING PLANS AND STRATEGIES FOR B2B2C E-MAIL**

Imaging that Tung Ling is like the Uni-President Group, which operates 7-11 convenient stores in Taiwan, dealers deliver their merchandise to Uni-President, then Uni-President distributes those to 7-11 franchises. When there are new regions with new 7-11 stores, Uni-President and dealers make more. Therefore, Tung Ling and dealers will cooperate to generate the most amount of merchandise, then staff from Tung Ling only need to recruit new regions of distributors. With more distributors, dealers can make greater deal in return, and so to the growth in Tung Ling’s revenue.

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IDENTIFYING ONLINE BIDDING STRATEGIES BY ANALYZING SUBJECTIVE DATA

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EXTENDED ABSTRACT

Many scholars have investigated the bidders’ behavior in online auctions, including online bidding strategies. Usually they used archival bidding data retrieved from the auction servers to analyze the behavior of the bidders. The information hidden inside the archival data, such as the bidding timing, bidding times, starting price, bid increment, and final price, etc., is objective and several bidding strategies were identified from those data. For example, ratchet bidding is identified when some bidders increase the current bid by the minimal bid increment [3] while jump bidding when some bidders bid in excess of the minimal necessary increment [5]. Early bidding is found when some bidders bid at the early time of an auction [1] while snipe bidding or late bidding when some bidders bid just before the auction’s end [2, 4]. Using a software bidding agent to bid is a strategy called agent bidding [7]. These findings from objective archival data have laid the foundation to the research on online bidding strategies.

However, online bidding is like playing game with some psychological elements involved in, which cannot be easily obtained by the objective data. For example, the objective data may show that some bidder’s first entry time is late, indicating a snipe bidding strategy was performed near the end of the auction, while he/she actually is using ratchet bidding strategy only at the late stage of an auction. Therefore, this study attempts to investigate online bidding strategies from another perspective. Instead of using objective archival data, this study tries to collect and analyze subjective data through a survey on the proxies of online bidding strategies. We believe that the subjective data can eliminate some biased information and reveal the actual bidding used the bidders, which can help researchers to better understand online bidders’ bidding behavior.

A survey was then conducted among the online bidders in Taobao.com because it is the biggest online auction website in China and it owns the most Chinese bidders. In the survey, questions on bidders’ perceptions of their bidding frequency, agent bidding frequency, bidding entry time and bid increment were developed and asked in the questionnaire, as the proxies of online bidding strategies. The subjective data were automatically recorded by the online survey.

In order to identify the bidding strategies used by the bidders, this study adopted a two-step cluster analysis method [6]. Based on the four proxies: perceived bidding frequency, perceived agent bidding frequency, perceived bidding entry, and perceived bid increment, we ran the first step. The hierarchical cluster analysis suggested a three-cluster solution. Then we indicated three clusters in the second step of K-mean cluster analysis on the four proxies to identify the details. The results revealed that Cluster 1 has the lowest perceived bid increment and use frequency of agent software; this indicates that these bidders bid manually and as low as possible, suggesting that they opt for ratchet bidding. Cluster 2 has an extremely high perceived agent bidding frequency and bid increment, suggesting that these bidders typically set a very high reservation price to the bidding agent and allow the latter to conduct the bidding for them. It was named as agent jump bidding because it has characteristics of both agent and jump bidding. Meanwhile, Cluster 3 is characterized by perceived late bidding as well as perceived low bidding frequency and bid increment, indicating the bidders perceive themselves enter auctions very late and place very few bids in the auction process. They are identified as sniper bidding strategy.

The three bidding strategies identified in this study, i.e., ratcheting bidding, agent jump bidding and sniper bidding, confirm the research findings in previous research. The reason why agent and jump bidding are combined to one cluster may be due to the special bidding mechanism of Taobao. Whenever you perform a jump bidding and raise the bid by a mount higher than the minimum bid increment, the bidding agent of Taobao will be automatically triggered and it just becomes an agent bidding, which generates the hybrid auction mechanism. In addition, early bidding was not identified in this study although it was found when some researchers analyzed objective archival data [1]. One reason is that Taobao auctions do not have time priority as Yankee auctions do. It is not necessary for bidders to enter the auctions early to get the priority for a tie. The second reason may lie in the characteristics of early bidding itself. Early bidding has been found less effective [1] and satisfactory [4] than other bidding strategies. People may have learned it during years of experience and then choose not to bid too early. As least from the perspective of bidders themselves, most of them believe their entry time is not early.

The research findings can help the researchers and practitioners in this line to understand better the bidding behavior of online bidders. It can also help the auction website owners to design their auctions in a more effective way. For example, they can provide options whether starting bidding agent or not when some bidders perform jump bidding strategy instead of triggering it directly. Some bidders would like to use jump bidding with a huge increase of the bid to show their determination of winning the auction to others. The automation of bidding agent originally designed in Taobao probably lessens the intimidating effect with only a small amount increased. Another insight from this study is that sellers can shorten the duration of their auctions a bit to increase the efficiency since bidders are not active in the early stage.

This study tries to collect and analyze the subjective data from a survey to identify the online bidding strategies. The research results confirm most of the bidding strategies in previous studies, indicating the validation of this method. Moreover,
subjective-data-analysis is supplementary to objective-data-analysis by including more psychological elements that the latter cannot capture easily. More subjective data should be applied in online bidding behavior studies because bidding is a process involving mental activities. For example, some bidder may first use bidding strategy A while drop it half way and switch to bidding strategy B. The actual information of such a bidding process can be more easily obtained from an interview or survey, rather than archival data. In addition, more subjective data can be collected from other auction websites other than Taobao to generalize the research findings.

**Keywords**: bidding strategy, online auctions, subjective data

**REFERENCES**


IMPACT OF BANNER AD POSITION, CONGRUENCE OF BANNER AD CONTENT AND WEBSITE CONTENT, AND ADVERTISING OBJECTIVE ON BANNER AD FIXATION, BRAND AWARENESS, AND PRODUCT KNOWLEDGE: AN EMPIRICAL STUDY OF A REVIEW WEBSITE IN THAILAND

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ABSTRACT
The aim of this research is to study impact of banner ad position (top, bottom, left and right) on (1) banner ad fixation, (2) brand awareness, and (3) product knowledge. Two moderator variables, (1) congruence of banner ad content and website content and (2) advertising objectives (to inform and to persuade), are also used in this study. This experimental research is conducted with sixteen webpages (4 banner ad positions x 2 conditions of congruence between banner and web contents x 2 banner objectives). Each webpage has the same content which is a restaurant review but banner ad and banner ad position are varied across the sixteen webpages. An eye-tracking tool, Mirametrix S2 Eye Tracker, was used to collect banner ad fixation data. Brand awareness and product knowledge data were collected with questionnaires. The experimental results indicate that banner ad position does not impact banner ad fixation, brand awareness, and product knowledge. We investigated congruence of banner ad content and website content, and found that banner ad position affected product knowledge but did not have an effect on banner ad fixation and brand awareness regardless of congruent conditions. On the other hand, we investigated advertising objective and found that banner ad position did not have an impact on banner ad fixation, brand awareness, and product knowledge in both information and persuasive objectives.

Keywords: Banner Ad Position, Congruence, Advertising Objective, Banner Ad Fixation, Brand Awareness, Product Knowledge.

INTRODUCTION
In recent years, using the Internet has become a mainstream activity in the society. By this reason, businesses greatly concentrate on the Internet associated media in order to reach their expected target groups or their potential customers. According to the Interactive Advertising Bureau (IAB), the 2014 full year Internet advertising revenue was $49.45 billion, 16% increase from the $42.78 billion reported in 2013 [6]. Internet advertising has become widespread trend in business circles. Banner ad is one of the broadly used Internet advertising tools in marketing communication. Yet, for an effective use of banner ad in webpage, position of banner ad is considered to be one of the major factors because lower positions of banner ad help Internet users recognize banner ad better than upper positions [4]. Besides, there are other two factors which influence the banner ad recognition: congruence of banner ad content and webpage content [3] [11], and advertising objectives [9]. All of three factors mentioned above persuade users to respond to marketing objectives in two stages: when the users look at the banner ad and when they recognize the banner ad. Therefore, in this study, the banner ad recognition is divided into two parts: (1) brand recognition, and (2) product recognition, which are called (1) brand awareness, and (2) product knowledge, respectively.

There are many researches which study about banner ad position. A research found that banner ad at top and bottom position did not impact the recognition [5]. Another one found that verbal banner ad would be evaluated more positively when positioned on the right rather than on the left of a webpage [12]. From two researches mentioned above, they investigated only two positions of banner ad. Still, there is a research studying four positions of banner ad which indicated that top position was most effective and the right position was least effective in terms of explicit memory [8]. There is another interesting research studying about the eye behavior of users when banner ad located in different positions around the masthead area of online newspapers [2]. As a result, we would like to study how visitors respond to banner ad when banner ad located in different position in a single content webpage like a restaurant review webpage. One real review website in Thailand was used in this research.

In summary, in this study, we investigate impact of banner ad position, congruence of banner ad content and website content, and advertising objectives on banner ad fixation, brand awareness and product knowledge. To measure about a look at banner ad, an eye tracker collects fixation more precisely and more meticulously than only using questionnaires. Thus, Mirametrix S2 Eye Tracker was used to collect banner ad fixation data, while questionnaires were used to collect brand awareness and product knowledge data.

OBJECTIVES
This study has three objectives as follow:
1. To study impact of banner ad position on banner ad fixation, brand awareness and product knowledge.
2. To study impact of banner ad position on banner ad fixation, brand awareness and product knowledge when banner ad content and website content are congruent or incongruent.
3. To study impact of banner ad position on banner ad fixation, brand awareness and product knowledge when advertising objectives are to inform or to persuade.

The Fifteenth International Conference on Electronic Business, Hong Kong, December 6-10, 2015
METHODOLOGY

Tools

Banner Ad

To select a type of banner, we considered that static banner is most suitable to this study. Static banner has less influence on visitors' attention than other types of banner. In this study, eight formats of banners are used, depending on two factors: (1) congruence of banner ad content, and (2) advertising objectives. Two different sizes of banner are Super Leaderboard (960 x 100) (for top and bottom position) and Skyscraper (160 x 600) (for left and right position). The actual dimension of Super Leaderboard is 970 x 90 [7]. However, we changed its size to 960 x 100 because we prefer the Super Leaderboard and the Skyscraper to have equal area in term pixel. The eight formats of banner are shown in Table 1.

Table 1. Banner ad format

<table>
<thead>
<tr>
<th>Banner ad</th>
<th>Dimension (W x H)</th>
<th>Congruence</th>
<th>Advertising objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Super Leaderboard 960 x 100</td>
<td>Congruent (Brownie)</td>
<td>To inform</td>
</tr>
<tr>
<td>2</td>
<td>Super Leaderboard 960 x 100</td>
<td>Incongruent (T-shirt)</td>
<td>To inform</td>
</tr>
<tr>
<td>3</td>
<td>Skyscraper 160 x 600</td>
<td>Congruent (Brownie)</td>
<td>To persuade</td>
</tr>
<tr>
<td>4</td>
<td>Skyscraper 160 x 600</td>
<td>Incongruent (T-shirt)</td>
<td>To persuade</td>
</tr>
</tbody>
</table>

A restaurant review website was chosen as the experimental website. To select banner ad content, we studied 166 people about congruence of 10 products that maybe displayed in a restaurant review website. From the survey, 72.29% of samples accepted that "brownie" is congruent with the restaurant review website. On the other hand, 87.35% of samples admitted that "t-shirt" is incongruent with the restaurant review website. As a result, the two products, "brownie" and "t-shirt" were selected to be product advertised in congruent and incongruent banner ad content in the restaurant review website, respectively. For the advertising objectives, persuasive banner ads provide information about promotion, while informational banner ads do not.

Webpage

The restaurant review website chosen is composed of two main areas, the review and the banner ad areas. The banner ad is designed to display in four different areas: top, bottom, left and right of the page. With four different banner ad position and eight different formats of banner ads as previously mentioned, there are 16 different webpages used in our experiments. Figure 1 show examples of webpages with different products and banner ad positions.

Figure 1. Example webpages: (a) “T-shirt” banner ad at the top of webpage, (b) “Brownie” banner ad at the bottom of webpage, (c) “T-shirt” banner ad at the left of webpage, (d) “Brownie” banner ad at the right of webpage
**Eye-Tracker**

The eye tracking device used in this study is “Mirametrix S2 Eye Tracker” (shown in Figure 2) [10]. It is a hardware part which tracks participants’ eye movements and collects eye-gaze data. This hardware device works with the “Eye tracking viewer software”. The software saves eye-gaze data as a CSV document as shown in Figure 3, which is used to summarize banner ad fixation data used in this study.

**Questionnaires**

We created two questionnaires for participants. The first questionnaire is about the review of the restaurant in the webpage. For an accurate result, we simulate a real scenario of a restaurant review website usage. The participants were urged to visit the webpage to find information about the restaurant from the review. After visiting the webpage, the participant was given two questionnaires. The first questionnaire is composed of questions about (1) restaurant name, (2) location, (3) opening hour, (4) menu, (5) reviewer’s name, (6) interest in the restaurant, and (7) interest in general restaurant reviews.

The second questionnaire gathers data which are banner ad details and demographic data. Questions about banner ad details are composed of (1) banner ad visibility (to check if the participant see the banner ad or not), (2) brand awareness (to collect data about the product brand on banner ad), and (3) product knowledge (to evaluate participant’s remembrance about the product on banner ad). Demographic data to be collected are composed of age, gender, education, handedness, visual impairment, Internet usage experience, Internet usage per day and interests in banner ad.

**Measurements**

Visibility of banner ad is measured by using “banner ad fixation”. Banner ad fixation is calculated from eye-gaze data collected by the eye-tracking device, using number of coordinates each participant looks in the banner ad area divided by total coordinates in the banner ad area. This proportion is then converted to percentage. Brand awareness and product knowledge are measured by using the correct answers each participant gives in the questionnaires. For brand awareness, there are five questions about logo and product type. For product knowledge, there are eight questions about product details in the advertising message.

**Procedure**

The empirical study was conducted in the following steps:

1. Researcher announced about the experiment and sought the volunteers to participate in the experiment. All volunteers chose their preferred date and time to join the experiment.
2. Each participant came to his/her appointment which was organized individually.
3. Researcher explained about data collection to the participant. To simulate a real scenario of a restaurant review website usage, the participant was briefed that he/she was looking at the review webpage to search for the restaurant information.
4. The Mirametrix S2 Eye Tracker was adjusted for each participant and started the calibration process.
5. Researcher started recording each participant’s eye-gazed data. Then the webpage was displayed to the participant.
6. The participant must close the webpage immediately when he/she finished using the webpage. Researcher stopped recording eye-gaze of each participant.
7. Participant was given two questionnaires to be complete.
Reliability
1. Some data was discarded especially in the case where participants indicated in the questionnaire that they did not see the banner ad on the webpage, even the data collected from the eye tracker showed that the participants did look at it.
2. This research used the real website, which in average is visited by 200 visitors per day, so that the participant will have real experience during the experiment. The restaurant referred in this research is physically existed. Also, the product advertised in banner ad are real product. As a result, the participant would not feel that he/she received made up information.
3. The static banner was used in this research to examine only the impact of the position because other types of banner, such as animated banner, may draw attention of the participants due to other factors.
4. Each types of banner ad can be divided into 6 parts for two dimensions, as shown in Figure 4:
   a. The first part is the logo (product brand).
   b. The second, the fourth and the sixth part is the product information.
   c. The third and the fifth part is the product pictures.

Elements of banners of both products were arranged in the same patterns, but different in logos, information and product pictures. Other details which include font, color and size (in pixels) of the two banners are identical.

Participants
160 undergraduate and graduate students from Chulalongkorn Business School, Chulalongkorn University, Thailand participated in the experiments. A summary of demographic information of the participants is shown in Table 2.

Table 2. Respondents’ demographic information

<table>
<thead>
<tr>
<th>Demographics</th>
<th>Distribution</th>
</tr>
</thead>
</table>
| Gender                | 36.25% male  
                          | 63.75% female |
| Age                   | 95.00% 18-25 years old  
                          | 5.00% 26-30 years old |
| Education             | 94.38% undergraduate  
                          | 5.63% graduate |
| Handedness            | 5.63% left  
                          | 93.13% right  
                          | 1.25% both |
| Eyesight              | 31.88% normal  
                          | 65.00% near-sighted  
                          | 2.50% far-sighted  
                          | 23.75% astigmatism |
| Internet usage experience | 1.88% Less than 3 years  
                          | 2.50% 3-5 years  
                          | 30.00% 5-7 years  
                          | 65.63% More than 7 years |
| Internet usage per day | 41.25% Less than 3 hours  
                          | 40.63% 3-5 hours  
                          | 13.13% 5-7 hours  
                          | 5.00% More than 7 hours |

Figure 4. Banner ad layouts: (a) layout for Super Leaderboard, and (b) layout for Skyscraper
The participants were 63.75% female. 95.00% were 18 to 25 years old. 94.38% were undergraduate students. 94.13% were right-handed. 31.88% have normal eyesight and 65.00% have near-sighted eyesight. 65.63% have more than 7 years of Internet usage experience. 41.25% use the Internet less than 3 hours per day (not including e-mail and mobile application usage). 63.132% are interested in banner ad.

RESULTS

The results of this experiment are presented in three sections, each section for each research objective. The results of each section are shown in table format with mean values and standard deviation (SD) in one table, and the results of the Kruskal-Wallis test for differences of banner ad fixation, brand awareness, and product knowledge are shown in a separated table.

Result 1: Impact of banner ad position on banner ad fixation, brand awareness and product knowledge

From Table 3, we found that the mean value of banner ad fixation at the right position is the highest and the one at the left position is the lowest. The mean value of brand awareness at the bottom and the left position is the highest and the one at the top position is the lowest. However, the differences of mean values of brand awareness are not much for four banner ad positions. In aspect of product knowledge, the mean value of product knowledge at the right position is higher than the others.

Kruskal-Wallis test results, at 95% confidence interval, shown in Table 4 indicate that there is no significant difference of banner ad fixation, brand awareness, and product knowledge for four banner ad positions.

Result 2: Impact of banner ad position on banner ad fixation, brand awareness and product knowledge when banner ad content and website content are congruent and incongruent

We investigated congruence of the banner ad content and the website content. From Table 5, when the banner ad content is congruent with the webpage content, we found that the mean value of banner ad fixation at the right position is highest. The mean value of brand awareness at the bottom position is highest. On the other hand, the mean value of product knowledge at the left position is highest and the one at the top position is lowest.

Kruskal-Wallis test results, at 95% confidence interval, shown in Table 6 indicate that there is no significant difference of banner ad fixation and brand awareness for four banner ad positions. On the other hand, there is a significant difference of product

<table>
<thead>
<tr>
<th>Demographics</th>
<th>Distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interest in banner ad</td>
<td>63.13% Interested  36.88% Uninterested</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Position</th>
<th>Banner Ad Fixation</th>
<th>Brand Awareness</th>
<th>Product Knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top</td>
<td>Mean</td>
<td>0.1304</td>
<td>1.80</td>
</tr>
<tr>
<td>Bottom</td>
<td>Mean</td>
<td>0.1266</td>
<td>2.05</td>
</tr>
<tr>
<td>Left</td>
<td>Mean</td>
<td>0.1169</td>
<td>2.05</td>
</tr>
<tr>
<td>Right</td>
<td>Mean</td>
<td>0.1516</td>
<td>1.92</td>
</tr>
<tr>
<td>SD</td>
<td>0.1730</td>
<td>1.09</td>
<td>1.32</td>
</tr>
<tr>
<td>SD</td>
<td>0.1408</td>
<td>1.11</td>
<td>1.76</td>
</tr>
<tr>
<td>SD</td>
<td>0.1379</td>
<td>1.04</td>
<td>1.61</td>
</tr>
<tr>
<td>SD</td>
<td>0.2245</td>
<td>1.19</td>
<td>1.50</td>
</tr>
</tbody>
</table>

Table 3. Mean and SD of banner ad fixation, brand awareness, and product knowledge when banner ad positions are different

<table>
<thead>
<tr>
<th>Chi-Square</th>
<th>Banner Ad Fixation</th>
<th>Brand Awareness</th>
<th>Product Knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td>df</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Asymp. Sig.</td>
<td>.724</td>
<td>.704</td>
<td>.324</td>
</tr>
</tbody>
</table>

Table 4. Kruskal-Wallis test of banner ad fixation, brand awareness, and product knowledge when banner ad positions are different

<table>
<thead>
<tr>
<th>Position</th>
<th>Banner Ad Fixation</th>
<th>Brand Awareness</th>
<th>Product Knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>0.1078</td>
<td>1.70</td>
<td>2.85</td>
</tr>
<tr>
<td>SD</td>
<td>0.1189</td>
<td>0.92</td>
<td>1.31</td>
</tr>
<tr>
<td>Mean</td>
<td>0.1040</td>
<td>2.10</td>
<td>3.60</td>
</tr>
<tr>
<td>SD</td>
<td>0.0825</td>
<td>1.07</td>
<td>1.85</td>
</tr>
<tr>
<td>Mean</td>
<td>0.1446</td>
<td>1.65</td>
<td>4.40</td>
</tr>
<tr>
<td>SD</td>
<td>0.1755</td>
<td>0.81</td>
<td>1.85</td>
</tr>
<tr>
<td>Mean</td>
<td>0.1887</td>
<td>1.75</td>
<td>3.90</td>
</tr>
<tr>
<td>SD</td>
<td>0.3029</td>
<td>1.16</td>
<td>1.89</td>
</tr>
</tbody>
</table>

Table 5. Mean and SD of banner ad fixation, brand awareness, and product knowledge when banner ad positions are different in congruent condition

<table>
<thead>
<tr>
<th>Position</th>
<th>Banner Ad Fixation</th>
<th>Brand Awareness</th>
<th>Product Knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>0.1078</td>
<td>1.70</td>
<td>2.85</td>
</tr>
<tr>
<td>SD</td>
<td>0.1189</td>
<td>0.92</td>
<td>1.31</td>
</tr>
<tr>
<td>Mean</td>
<td>0.1040</td>
<td>2.10</td>
<td>3.60</td>
</tr>
<tr>
<td>SD</td>
<td>0.0825</td>
<td>1.07</td>
<td>1.85</td>
</tr>
<tr>
<td>Mean</td>
<td>0.1446</td>
<td>1.65</td>
<td>4.40</td>
</tr>
<tr>
<td>SD</td>
<td>0.1755</td>
<td>0.81</td>
<td>1.85</td>
</tr>
<tr>
<td>Mean</td>
<td>0.1887</td>
<td>1.75</td>
<td>3.90</td>
</tr>
<tr>
<td>SD</td>
<td>0.3029</td>
<td>1.16</td>
<td>1.89</td>
</tr>
</tbody>
</table>

Table 6. Mean and SD of banner ad fixation, brand awareness, and product knowledge when banner ad positions are different in incongruent condition
knowledge for four banner ad positions, the difference is observed when comparing the banner ad at the top to the left position.

Table 6. Kruskal-Wallis test of banner ad fixation, brand awareness, and product knowledge when banner ad positions are different in congruent condition

<table>
<thead>
<tr>
<th>Position</th>
<th>Banner Ad Fixation</th>
<th>Brand Awareness</th>
<th>Product Knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chi-Square</td>
<td>1.576</td>
<td>2.012</td>
<td>8.015</td>
</tr>
<tr>
<td>df</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Asymp. Sig.</td>
<td>.665</td>
<td>.570</td>
<td>.046</td>
</tr>
</tbody>
</table>

From Table 7, when the banner ad content is incongruent with the webpage content, we found that the mean values of banner ad fixation at the top and bottom position are higher than the others. The mean value of brand awareness at the left position is highest. On the other hand, the mean value of product knowledge at the left position is lowest.

Table 7. Mean and SD of banner ad fixation, brand awareness, and product knowledge when banner ad positions are different in incongruent condition

<table>
<thead>
<tr>
<th>Position</th>
<th>Banner Ad Fixation</th>
<th>Brand Awareness</th>
<th>Product Knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>0.1529</td>
<td>1.90</td>
<td>3.50</td>
</tr>
<tr>
<td>SD</td>
<td>0.2149</td>
<td>1.25</td>
<td>1.28</td>
</tr>
<tr>
<td>Banner Ad Fixation Mean</td>
<td>0.1493</td>
<td>2.00</td>
<td>3.15</td>
</tr>
<tr>
<td>Banner Ad Fixation SD</td>
<td>0.1810</td>
<td>1.17</td>
<td>1.69</td>
</tr>
<tr>
<td>Brand Awareness Mean</td>
<td>0.0892</td>
<td>2.45</td>
<td>2.30</td>
</tr>
<tr>
<td>Brand Awareness SD</td>
<td>0.0814</td>
<td>1.10</td>
<td>0.57</td>
</tr>
<tr>
<td>Product Knowledge Mean</td>
<td>0.1145</td>
<td>2.10</td>
<td>3.60</td>
</tr>
<tr>
<td>Product Knowledge SD</td>
<td>0.0938</td>
<td>1.21</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Kruskal-Wallis test results, at 95% confidence interval, shown in Table 8 indicate that there is no significant difference of banner ad fixation and brand awareness for four banner ad positions. On the other hand, there is significant difference of product knowledge for four banner ad positions. The difference is found when comparing the banner ad at the left to the rest of the positions.

Table 8. Kruskal-Wallis test of banner ad fixation, brand awareness, and product knowledge when banner ad positions are different in incongruent condition

<table>
<thead>
<tr>
<th>Position</th>
<th>Banner Ad Fixation</th>
<th>Brand Awareness</th>
<th>Product Knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chi-Square</td>
<td>.968</td>
<td>3.397</td>
<td>17.088</td>
</tr>
<tr>
<td>df</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Asymp. Sig.</td>
<td>.809</td>
<td>.334</td>
<td>.001</td>
</tr>
</tbody>
</table>

Result 3: Impact of banner ad position on banner ad fixation, brand awareness and product knowledge when advertising objectives are to inform or to persuade.

From Table 9, when advertising objective is to inform, we found that the mean value of banner ad fixation at the bottom and right positions are higher than the top and left positions. The mean value of brand awareness at the top position is lowest, the mean value of product knowledge at the right position is highest.

Table 9. Mean and SD of banner ad fixation, brand awareness, and product knowledge when banner ad positions are different for informational objective

<table>
<thead>
<tr>
<th>Position</th>
<th>Banner Ad Fixation</th>
<th>Brand Awareness</th>
<th>Product Knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>0.0838</td>
<td>1.75</td>
<td>3.20</td>
</tr>
<tr>
<td>SD</td>
<td>0.0980</td>
<td>1.12</td>
<td>1.06</td>
</tr>
<tr>
<td>Banner Ad Fixation Mean</td>
<td>0.1333</td>
<td>2.05</td>
<td>3.00</td>
</tr>
<tr>
<td>Banner Ad Fixation SD</td>
<td>0.1410</td>
<td>1.15</td>
<td>1.38</td>
</tr>
<tr>
<td>Brand Awareness Mean</td>
<td>0.0883</td>
<td>2.15</td>
<td>3.10</td>
</tr>
<tr>
<td>Brand Awareness SD</td>
<td>0.1105</td>
<td>1.04</td>
<td>1.55</td>
</tr>
<tr>
<td>Product Knowledge Mean</td>
<td>0.1356</td>
<td>2.05</td>
<td>3.75</td>
</tr>
<tr>
<td>Product Knowledge SD</td>
<td>0.2002</td>
<td>1.15</td>
<td>1.65</td>
</tr>
</tbody>
</table>

Kruskal-Wallis test results, at 95% confidence interval, shown in Table 10 indicate that there is no significant difference of banner ad fixation, brand awareness, and product knowledge for four banner ad positions when the advertising objective is to inform.
From Table 11, when advertising objective is to persuade, we found that the mean values of banner ad fixation at the top and the right positions are higher than the bottom and the left positions. The differences of mean values of brand awareness are not much for four banner ad positions. On the other hand, the mean value of product knowledge at the top position is lowest.

Table 12. Kruskal-Wallis test of banner ad fixation, brand awareness, and product knowledge when banner ad positions are different for persuasive objective

<table>
<thead>
<tr>
<th>Position</th>
<th>Banner Ad Fixation</th>
<th>Brand Awareness</th>
<th>Product Knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Chi-Square</td>
<td>df</td>
<td>Asymp. Sig.</td>
</tr>
<tr>
<td></td>
<td>Mean</td>
<td>Top</td>
<td>Bottom</td>
</tr>
<tr>
<td>Banner Ad Fixation</td>
<td>1.225</td>
<td>.437</td>
<td></td>
</tr>
<tr>
<td>Brand Awareness</td>
<td>.747</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Product Knowledge</td>
<td>.1225</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Kruskal-Wallis test results, at 95% confidence interval, shown in Table 12 indicate that there is no significant difference of banner ad fixation, brand awareness, and product knowledge for four banner ad position when advertising objective is to persuade.

**DISCUSSION**

*Result 1* indicates that banner ad position does not impact banner ad fixation, brand awareness and product knowledge. This experiment results confirm the results of previous research that position does not impact fixation and recognition [11][2][5][8]. On the other hand, the results are not consistent to the result of [4]. The finding shows that lower visual field attracts more attention (fixation, click and recognition). One possible clarification is a difference in experiment settings. Webpage used in this study is a single content webpage (the restaurant review). This type of webpage distracts visitors’ attention less than other types. As a result, eye movements of participants would seem like reading. A multiple content webpage, for example a homepage, bring about random eye movements. Therefore, if the banner ad position is close to a more interesting content, it is likely to attract eye movements. The difference between a single content webpage and a multiple content webpage may lead to a different result.

Additionally, this study investigated congruence of banner ad content and webpage content.

*Result 2* exposes that when banner ad content and webpage content are in both congruent and incongruent conditions, the banner ad position does not have an impact on banner ad fixation and brand awareness. However, we observe that the mean value of product knowledge is lowest in the congruent condition and it is statistically different from other positions, while its mean value is highest in the congruent condition and statistically different from the top position. One possible explanation is that when the visitors started reading the restaurant review on the left of the webpage, if banner ad content is congruent with webpage content, the visitors may understand that the banner ad is a part of the review and read it. On the other hand, if the banner ad content is incongruent with the webpage content, the visitors may be able to differentiate the banner ad from the review and define the area that they should gaze through read the content of the review.

*Result 3* we examined the advertising objective and found that the banner ad position does not impact banner ad fixation, brand awareness and product knowledge. This result does not confirm that position and objective affect the effectiveness of advertising [9]. An apparent difference between our study and previous finding [9] is types of banner ad used. Animated ad was used in [9], while static ad was used in our study.
CONCLUSION

From this study, there are three main results as follow:

1. Banner ad position does not impact banner ad fixation, brand awareness and product knowledge.
2. Banner ad position does not impact banner ad fixation and brand awareness when banner ad content and website content are congruent or incongruent. However, banner ad position impacts product knowledge in different ways when banner ad content and website content are congruent and incongruent.
3. Banner ad position does not impact banner ad fixation, brand awareness and product knowledge when advertising objectives are to inform or to persuade.

Three conclusions as mentioned above suggest that banner ad fixation and brand awareness do not depend on banner ad position. On the other hand, product knowledge depend on the banner ad position when banner ad content and webpage content are in congruent and incongruent conditions. As a result, selecting banner ad area in a single content webpage may be based on the congruent condition. If a product to be advertised is congruent with webpage content, business owner might select the left position before the others and might avoid placing the banner ad at the top position. If a product to be advertised is incongruent with the webpage content, business owner should avoid placing the banner ad at the left position. For other positions, business owner might select the positions according to price or concern about a number of visitors, target group or popularity of website. On the contrary, if business owner has banner ad area at the top position, the owner should select a product that incongruent with webpage content. If business owner has banner ad area at the left position, the owner should select a product that congruent with webpage content.

ACKNOWLEDGEMENT

The authors would like to acknowledge the Chulalongkorn Academic Advancement into Its 2nd Century Project for financial support and the Business Visualization Research Group, Chulalongkorn Business School, Chulalongkorn University for supporting of Mirametrix S2 Eye-tracker used in this study.

Moreover, the authors would like to thank the owners of trick2u.com (the review website), Casa Carlino (the brownie shop) and BeFearless (the T-shirt shop) for kindly allow the use of real product and website in the experiment.

REFERENCES

INTEGRATING PERSONALITY AND EMOTION FOR HUMAN CROWD SIMULATION

Jacob Sinclair, James Cook University, Australia, Jacob.Sinclair@my.jcu.edu.au
Carrie Siu Man Lui, James Cook University, Australia, Carrie.Lui@jcu.edu.au

ABSTRACT

Existing research attempts to create realistic crowd simulations by incorporating personality and emotion into intelligent agents. However, personality and emotion were considered separately in existing studies, where the interactions of them are ignored. The main objective of this paper is to propose and implement a framework for crowd simulation with integration of the impacts and interactions of personality and emotion. An interactive solution based on the proposed framework is also developed for visualizing the crowd navigation behavior and collecting the related trajectory data. Three simulated scenarios: pass through, narrow passage, and emergency situation are used to validate the framework and compare the results with recent studies.

Keywords: Crowd simulation, agent behaviour, emergency scenario, agent emotion, decision making.

INTRODUCTION

Developing human like crowds is a challenging problem in crowd simulation. This is because it requires a balance between realism and computational efficiency, as well as to consider many different components such as group behavior, cognitive modeling, motion synthesis, crowd movement and rendering [5].

Affective aspects, such as emotion and personality, influence human decisions and behaviors. Pelechano et al [11] state’s that including affective aspects into crowd simulation can create individual differences among the agent’s, hence producing realistic heterogeneous agents with natural behaviors. Personality is a combination of physical, emotional and social features that define an individual. Personality can be expressed in the form of behaviors and influence our behaviors as well as the way we make decisions. For example, people that are introverted generally prefer to have greater interpersonal distances, as they do not feel comfortable interacting with other people. They also tend to be resistant to any visual interaction with others. People who are mix of neurotic and introverted have more self-control, rigid behaviors and tend to display an increase in uncoordinated movements [11].

Modeling of personalities can create more realistic agents and because personality can be expressed in the form of behavior, intergrading personalities in crowd simulation will lead to more realistic behaviors in different situations [11].

Emotions are personal characteristics that are influenced by mood, personality and motivation. Some of the most commonly known emotions are joy, sorrow, hate and fear. Emotions are commonly known to effect facial expression. However, Stamatopoulou et al [12] state’s that emotion can influence an agent’s ability to perceive, learn, behave and communicate within an environment.

Existing research attempted to create realistic crowd simulations by incorporating personalities [3] [6] [7] [10] [13] and emotion [9] [12]. However these aspects were considered separately in existing studies [6] [12]. However, personality and emotion will affect each other internally. Personality will define one’s emotional profile. While personality is not easily changed by itself in a short period of time, emotions are considered more dynamic and depend on different situations. Situations like agent interaction and communication can cause emotional contagion [6]. An integrated framework is missing and interactions of these aspects are ignored. The combination of personality and emotion can improve realistic crowd simulations and reveal emerging behaviors.

The purpose of this project is to investigate how to integrate affective aspects into crowd behaviors effectively. This project aims to investigate and implement 1) the influence of affective aspects on agent’s behaviors in crowd simulation, 2) a crowd simulation framework that can incorporate personality and emotion to an agent’s parameters and decision process, 3) an interactive application to demonstrate the simulation framework.

RELATED WORK

Personality and emotion play a significant role in human decisions and behaviors. The inclusion of individual differences of personality and emotion in agents is believed to be able to create more realistic characters with natural behavioral differences [11]. Exiting crowd simulation studies considering the impact of affective aspects to agents behavioral are mostly scenario-specific and focused on only a few personality traits or emotions [7].

Personality

Various personality models have been integrated in crowd simulation studies attempting to achieve more realistic and human like crowd behaviors by creating heterogeneous agents with different personality profiles [3] [6] [9] [13]. Turkay et al. [13] proposed a behavioral model for crowd simulation, which incorporated one personality trait, aggressiveness. The model uses analytical behavior maps to control agent behaviors with agent-crowd interactions. In their simulation, an agent’s behavior is composed of its behavior state and behavior constants. Behavior state is determined by the behavioral values assigned to each cell in the 2D

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grid behavior map. Agents in the same cell will share the same behavioral values. These values can be altered temporally and spatially representing agent-crowd interactions. Behavioral constants are agent-specific values presenting the agent’s personality attributes. They proved the validity of their simulation model by comparing the simulated results to a real-world scenario of 60 students evacuating a room in an emergency situation.

The Eysenck 3-Factor personality model and the 6 personality trait theories aggressive, assertive, active, impulsive, shy and tense have been used to simulate heterogeneous crowd behaviors [6]. Eysenck 3-Factor personality model is a biologically based model of three factors of personality called psychoticism, extraversion and neuroticism. Based on perceived personality data collected from user study with users watching videos of different crowd simulation scenarios, different personality traits are mapping with different values of agents parameters such as neighbor distance, maximum number of neighbors, planning horizon, radius and preferred speed. The simulation demonstrated emerging behaviors produced by agents with different personalities. For instance, shy agents would stay behind and allow the other agents to exit first. Similarly, in the evacuation scenario when a group of aggressive agents would slow each other down causing them to exit the building slower than the other agents with different personalities [6]. The OCEAN model is another popular personality model used in crowd simulation [3]. The OCEAN model describes five dimensions of personality that are used to define human personality. OCEAN stands for openness, conscientiousness, extroversion, agreeableness and neuroticism.

Although personality has been included in pervious studies, it is considered as a fixed characteristic of the agents remain the same during the simulation. However, human decisions and behavior can be changed by more situational factors such as emotion.

**Emotion**

Similar to personality, emotion is considered as an independent factor in crowd simulation in pervious studies. Stamatopoulou et al. [12] used one of the basic emotion’s horror in their crowd simulation. In the study, horror was represented by 6 different levels: calm, alarm, fear, terror, panic, and hysteria. An agent’s horror level is based on the situation and the environment, for example when a calm agent perceives that there is danger the horror level increases and its horror level will be changed from calm to alarm. The horror level was tested in an evacuation scenario. The evacuation scenario revealed that agents who got lost on their way to the buildings exit increased their horror level to the state of hysteria preventing them from following the buildings evacuation plan.

Nguyen et al. [8] uses a behavior table that map particular mood levels to a list of expected behaviors. The emotion studied by is aggression. The levels of aggression used are avoidance, neutral, curious, aggressive posture, aggressive non-lethal and aggressive lethal action. Each aggression level is linked to specific list of expected behaviors. For example, at neutral level, the expected behavior of an agent is wandering, at avoidance level, the agent’s expected behaviors include throwing rocks, pushing, hand-to-hand fighting, and shooting. Ahn et al. [1] considers emotions of Non-Player Characters. They used fuzzy functions and rules to control the conditions of emotion and reasonable inference is implemented to determine the control value of an agent’s actions such as speed and direction.

Most of these studies focused on emotions only. Even though emotions are dynamic and are affected depending on the situation they do not combine it with any other type of affective aspect. Also most studies focus on affecting emotions in single type of way, but to make real human like simulations we need to consider multiple ways of affecting the agents emotions [8].

**FRAMEWORK DESIGN**

Figure 1. The proposed affective aspect framework.
The proposed framework developed for this project is shown in Figure 1. This framework defines how personality and emotion affects an agent’s decision-making, status and behavior. This framework also describes how communication and interaction between two agents affect each other’s emotions and decisions. In this framework an agent’s behavior is affected by its decision-making, agent status, and the dynamic environment. While the static agent’s affective characteristics such as personality will affect an agent’s decision making, the dynamic affective characteristic such as emotion is affected by the decision making at the same time influencing the agent’s status. Between two agents their decision making and emotions will affect each other. An agent’s emotions (Agent A) can affect other agents (Agent B) when those emotions are strong enough.

The operation of the framework starts by defining the personality values an agent will have. Then the personality values are sent to the agent’s status module, which determines the agent’s parameters. The agent’s personality is then sent to the emotion module to set the agents emotional parameters. An agent then determines their path to their goal using the decision making module. Agent’s personality values are sent to the decision making module to influence the path chosen by the agent. For example agents with an aggressive personality would take the most direct path to their goal while an agent with a shy personality would take a path to their goal that has the least amount of people in their way.

Once the decision making module has determined what path will be taken, instructions are then sent to the behavior module. The behavior module will then move the agent down that chosen path. The environment can affect an agent’s path with different situations, for example a path being blocked or dangerous situations like fires present in the environment. When a situation occurs within the agent’s perception range, the agent will be influenced by that situation. The decision making module will then process the situation to determine what problem occurred. Once the problem is determined, the decision making modules may interact with the emotion module instructing the agent to respond accordingly. If an agent’s emotions reach a certain level the agent’s emotions then affect the agent’s parameters in the agent status module. Also once the problem is determined the agent’s decision making module will calculate a new path to take to the goal.

IMPLEMENTATION AND DETAILS

This section presents the implementation details of the proposed framework.

Behavior Module

One of the fundamental problems needed to be handled in crowd simulation is how agents solve collision with both static and dynamic obstacles. Reciprocal Collision Avoidance 2 (RVO2) [2] library is an easy-to-use implementation of the Optimal Reciprocal Collision Avoidance (ORCA) formulation for multi-agent simulations. This tool provides the ability to setup crowd simulation scenarios by setting agent default parameters (Max. neighbors distance, max. number of neighbors, planning horizon, obstacle planning horizon, agent radius and max. speed). Table 1 shows the default agent parameters. Although RVO2 is a useful library it does not provide any path finding capabilities as it only allows agents to move directly to a goal using the preferred velocity.

<table>
<thead>
<tr>
<th>Agent Parameters</th>
<th>Default Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. Neighbors Distance</td>
<td>15</td>
</tr>
<tr>
<td>Max. Number of Neighbors</td>
<td>10</td>
</tr>
<tr>
<td>Planning Horizon</td>
<td>10</td>
</tr>
<tr>
<td>Obstacle Planning Horizon</td>
<td>10</td>
</tr>
<tr>
<td>Agent Radius</td>
<td>1.0</td>
</tr>
<tr>
<td>Max. Speed</td>
<td>2.0</td>
</tr>
</tbody>
</table>

Decision Making Module

The decision making module focuses on how the agents choose their path to a goal. For this project, a local path finding method is implemented due to its realistic reflection on the situation in which individuals in crowds may not have full knowledge of the environment. The local path finding used for this project is a point to point network in which the agents move around the environment from one point to another point that has a connection to it; in this case it is called neighboring point. At the start of a simulation the agents move to the closest point from where they were spawned, from there on they rely on their personality to determine the next point for them to get closer to the goal. An agent’s path can be interrupted when situations such as an obstacle or dangerous events (fire) blocks their path to their target point. This forces the agent to return to its previous point it came from and revise through the neighboring points to take an alternate path.

Personality Module

Personalities are represented in existing studies [3] [6] [9] [11] [13] by variations of agents parameters to provide the ability to simulate heterogeneous agents behaviors when different agents encounter the same situation and environment. In this implementation, personality is not only directly mapping into the agents parameters, but also can influence an agent’s preferences in path finding decisions.
Guy et al. [6] provides agents with different RVO2 agents parameters to represent different personalities. However, they did not provide a path finding approach to the RVO2 library, forcing agents to go to the goal directly without thinking of the best path or a path picked based on their personality. This implementation adds a path finding solution to RVO2 that considers an agent’s personality to model more realistic decisions processed in crowd simulation.

Three personality traits were implemented in developing realistic agents; these were shy, impulsive and aggressive. The aggressive and shy personalities were chosen due to being opposites of each other, while impulsive was selected as a medium. Guy et al. [6] had already mapped the RVO2 parameters to each of these personality traits. The only difference between Guy et al. and this implementation is that the radius of each personality has been cut in half allowing better movement between agents in large crowds. Table 2 shows the agents parameters mapping for each personality used in this implementation. Each personality trait determined different preferred paths or types of paths an agent will pick in order to reach their goal. An agent with an aggressive personality will look for the quickest path to the goal. This has been developed into the path finding by selecting the closest point to the goal from a list of neighboring points that were given to the agent from its current point. Agents with an impulsive personality don’t go for the quickest path to the goal but go for a more adventures path [14]. The path finding incorporates the impulsive personality by selecting alternative paths to the goal allowing impulsive agents to take a more adventurous path, except when there is only one path to the agent’s goal the impulsive agent will then take that path instead. Agents with a shy personality looked for a path to their goal that has the least amount of agents to interact with. The path finding determined this by how many agents are between the current point and each neighboring point using a detector that has been placed between each one. A shy agent then takes the point that has the least number of agents between them, which can end up making shy agents move further away from their goal. An agent’s personality was also visually represented using 4 different colored clothes in the implementation. These 4 colors were red for aggressive, green for impulsive, yellow for a shy, and blue for no specific personality.

Emotion Module

Emotions have been implemented in crowd simulations in different ways. Emotion can be represented by discrete level or category system [12]. For example, a single emotion such as horror is represented by several levels of horror starting from calm, to alarm, fear, terror, panic and all the way up to hysteria. Emotions can also be represented by continuous values like the stress level modeled in [7]. However, both these representations of emotions and mapping to corresponding behaviors ignore the fact that individual regulate emotion formation internal to an individual and emotion expressed an individual depends on one’s personality [4]. Agents’ emotions can be affected by different situations in the environment and other agents as long as the situations and the other agents are within an agent’s perception range. For example, a fire breaks out on one side of a town, the people on that side are emotionally affected but the people on the other side far away from the fire may not be emotionally affected. Other agents can also affect agent emotions in different ways such as emotions propagation from the agents around them.

This study improves the representation of emotion taking account the difference of emotion formation and emotion expression. A threshold system is used to represent multiple agent emotions for the project. The threshold values vary depends on the personality of an agent. The threshold system works by using two opposite emotions like happy and sad or angry and calm and setting a high threshold to one and a low threshold to the other. Each two opposite emotions are modeled with a shared value that can be increased or decreased based on different situations and with corresponding threshold pairs monitored. If that value reaches or passes one of the thresholds, the corresponding emotion will start to affect an agent’s decision and behavior.

Six emotions were used and split into three pairs of opposite emotions. These emotions were happy and sad, stressed and relaxed, angry and calm. These emotions are used, as they are most relevant for crowd simulation and can co-exist with the other. For example an agent can be happy about something, angry towards something and stressed at the same time [8].

Situations were implemented to influence an agent’s emotion values; they were danger, time pressure, obstacle interference, and interaction with other agents. Dangerous situations are things that can threaten an agent’s life such as natural disasters (fire, floods, earthquakes, etc.). Danger affects the emotion values in this implementation by increasing the stressedRelaxed and angryCalm values and decreasing the happySad value. Time pressure is the attempt to reach a goal by a particular time frame. If an agent does not reach its goal within a certain time frame the stressedRelaxed value is increased and the time frame starts again.

<table>
<thead>
<tr>
<th>Traits</th>
<th>Max. Neighbors</th>
<th>Max. Number of Neighbors</th>
<th>Planning Horizon</th>
<th>Obstacle Planning Horizon</th>
<th>Agent Radius</th>
<th>Max. Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aggressive</td>
<td>15</td>
<td>20</td>
<td>31</td>
<td>31</td>
<td>0.6</td>
<td>1.55</td>
</tr>
<tr>
<td>Impulsive</td>
<td>30</td>
<td>2</td>
<td>90</td>
<td>90</td>
<td>0.4</td>
<td>1.55</td>
</tr>
<tr>
<td>Shy</td>
<td>15</td>
<td>7</td>
<td>30</td>
<td>30</td>
<td>1.1</td>
<td>1.25</td>
</tr>
<tr>
<td>No Personality</td>
<td>15</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>1.0</td>
<td>2.0</td>
</tr>
</tbody>
</table>

Table 2. The agent parameters for each personality.
Obstacle interference is when an obstacle or barrier blocks an agent from taking a particular path to their goal forcing that agent to go back. When an agent is blocked by an obstacle the angryCalm and stressedRelaxed values will be increased bringing them closer to their angry and stressed threshold.

When a threshold is reached an agent’s parameters, which is the agent’s status are changed to reflect the impacts of that emotion. But not every parameter is affected for each emotion. For example when bored, an agent’s planning horizon, planning obstacle horizon will change. When an agent is stressed all parameters are affected. Emotion propagation is when agents who have already reached an emotional threshold affect other agents around them. They affect the other agents by slowly increasing their values of that particular emotion threshold. Heterogeneous agents are initiated in this framework by randomly generating the emotional thresholds for each opposite emotion pairs with a defined range based on an agent’s personality. Different personalities each have different levels in which a person can tolerate and control their emotions (See Table 3). For example an agent with aggressive personality is less likely to be able to control their anger compared to an agent with a shy personality. Similarly an impulsive agent can get excited quicker than an aggressive agent.

<table>
<thead>
<tr>
<th>Traits</th>
<th>Happy</th>
<th>Sad</th>
<th>Stress</th>
<th>Relaxed</th>
<th>Angry</th>
<th>Calm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aggressive</td>
<td>15</td>
<td>20</td>
<td>31</td>
<td>31</td>
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<td>10</td>
<td>10</td>
<td>1.0</td>
<td>2.0</td>
</tr>
</tbody>
</table>

**TEST SETUP AND RESULTS**

**Test Setup**

Three testing scenarios are created to evaluate the implementation of the proposed framework. These three scenarios are path-through, narrow passage and emergency. The environments were developed to see if any emerging behaviors as observed in previous studies and expected by theories can be produced by the implementation of the proposed framework. For example Guy et al. [6] found that each time a new aggressive agent was added to the environment the average speed of the aggressive agent’s changed. The aggressive agents began to exit the room slower than non-aggressive agents. This emerging behavior is known as “faster is slower”.

The pass through scenario comprised group of 144 agents of a single personality passing through the other group of 288 agents with no personality. 4 tests were run with a group of shy agents vs a group of agent with no personality, a group of aggressive agents vs a group of agent with no personality, a group of agents with impulsive personality vs a group of agent with no personality, and vs a group of agent with no personality vs another group of agent with no personality with no personality.

The narrow passage scenarios is developed to observe any emerging behavior with a crowd of agents with different personalities and agents with no personalities would get through a narrow exit about 3 meter wide. The narrow passage environment was set to simulate 324 individual agents in each test and multiple tests have been run with different personality distribution of the agents. The emergency scenario is developed in order to demonstrate the emotion formulation and propagation among agents with different personality traits. The emergency scenario has a dangerous element in the form of a fire. A room with blocked exits is used in this scenario. 64 agents (16 aggressive, 16 impulsive, 16 shy, and 16 without personality) are evenly allocated at the four corners of the room and set to make their way to one of the two exits located on the opposite sides of the room.

**Test Results**

In the pass through scenario, the test of two groups of agents passing through each other revealed differences in agents’ personality results in a very different formation when the two groups of agents pass through each other. Figure 2 shows the screenshots of the simulation when the two groups of agents passing through each other. For example, aggressive and impulsive agents had the tendency of taking a direct path through the agents with no personality without having to change their route (See Figure 2a and 2b). The aggressive agents would also form a straight line in order to move through the crowd. Agents with a shy personality tended to go around the agents with no personality to avoid them (See Figure 2c).

For the narrow passage scenario, 3 tests were conducted with the narrow passage environment 324 agents in each test. Each of the agent’s personality was selected randomly for the test. The narrow passage environment tests revealed that all agents would easily get through the narrow passage until some shy agents held back near the end of the narrow passage forcing aggressive agents to go around them or they were forced to go back until they were able to find a way around. The impulsive agents got through the crowd easily by forcing their way through the other agents. This was proven in one test by three impulsive agents actually appearing late during the test and was able to get through the remaining agents and exit before any other agents could. Agents with no personality tended to stay away from the center of the crowd by making their way through the narrow passage from the left and right sides (See Figure 3). After all the tests it was found that the quickest was the impulsive agents as they were all able to get through the narrow passage first. The second quickest was the aggressive agents and then the shy agents.
Figure 2. Groups of agents with different personality pass through group of agents without personality.

Figure 3. Agents with different personality walking through the narrow passage.
Figure 4 shows a screen capture of the emergency scenario. A fire was started in the middle of the room at the beginning of the simulation. Figure 5 shows the results of the emergency scenario. The figure shows that agents with different personality traits have different rate of emotion formulation, showing the proposed framework with the interaction of personality and emotion influence agent’s behavior is working properly.

**CONCLUSION**

This project does have some limitations. The current implementation only used the variations allowed by the RVO2 library; future research may implement the proposed framework with other collision avoidance and simulation methods to see if there are any differences or more realistic behavior are possible by overcoming some limitation of the RVO2 library. For instance, RVO2 lacks the ability to allow agents to move up or down a 3D environment; this is because RVO2 uses 2D vectors to move the agents. Future research may extend the navigation capability to 3D environments like multi-story buildings and 3D terrains.

This study implemented a simple local path finding by using a point-to-point network; other local path finding techniques can also be implemented compare the efficiency and realism of the simulation. The proposed framework may also be extended by giving the ability to agents to memorize the paths they have visited and the ability to learn from the environment, past behaviors and other agents.
The main goal of this project was to integrate personality and emotion into crowd simulations with an integrated framework. Three personalities were implemented and integrated into the path finding and agent parameters; these provide a framework and foundation to be easily extended to include more personality aspects in crowd simulation.

Similarly, the emotional threshold system implemented in this study provides a solid framework to allow additional emotion dimension to be added to the simulation. Future research can consider the impacts of emotions on behaviors and actions other than navigation of crowd.

Like many simulation studies, evaluating the similarity and validity of the simulation to reality are desired. Future research may try to compare crowd behavior data extracted from mass event videos to the data generated by the implementation used in this study. The current study not only proposed a crowd simulation framework that incorporates personality and emotion but also improved different aspects in existing crowd simulation approaches by: 1) integrated the impacts of personalities in path finding, 2) implemented the concept of emotion regulation with a new way of integrating emotions to crowd simulation through a threshold system, 3) extended emotion formation for crowd simulation to allow agents to have multiple emotions at the same time.

REFERENCES
INTERNET OF THINGS (IOT) IN E-COMMERCE FOR PEOPLE WITH DISABILITIES

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ABSTRACT
The Internet of Things (IoT) perceives and recognizes the physical world by taking advantage of smart devices. The world’s largest minority are people with disabilities. IoT can lower barriers for the disabled people in accessing information. Increasing Internet accessibility can help to make that happen for both social and economic benefit. This paper presents the proposed integrated framework of the IoT and cloud computing for people with disabilities such as sensory (hearing and vision), motor (limited use of hands) and cognitive (language and learning disabilities) impairments in the context of business-to-consumer (B2C) e-commerce context. We conclude that IoT-enabled services offer great potential for success of disabled people in the context of e-commerce.

Keywords: e-business, electronic commerce, internet of things, disable user.

INTRODUCTION
An online vendor seeks to offer positive online purchasing experiences for online consumers of all ages. According to the World Health Organisation [22] a billion people in the world, which is 15% of the total population has disability that limits their participation in the community. People with disabilities have limitations for going shopping, which put them at inconvenience because of their physical handicap. However, disabled people can gain a sense of emotional stability by online shopping. Therefore, e-commerce need to be accessible to all consumers, including those with disabilities. Though, if e-commerce websites are inaccessible, consumer with disabilities do not have the equal access they are guaranteed by law. Many online consumers may have various types of disabilities, such as sensory (hearing and vision), motor (limited use of hands) and cognitive (language and learning disabilities) impairments. Because of the Internet availability, online shops give consumer the ease of buying and selling products. Inclusion of people with disabilities and the aged in mainstream society has improved significantly through the continuous development of guideline and assistive technologies together with the use of Information and Communications Technology (ICT). Such as World Web Content Accessibility Guidelines (WCAG) developed by Wide Web Consortium (W3C) have to reduce the barrier for accessing information. WCAG provides recommendations to make web content more accessible for user of all ages and with disabilities. For that reasons, the Web Content Accessibility Guidelines (WCAG 2.0) [20] helps to make the website accessible for users of all ages and with disabilities such as color blindness, deaf users, and age related vision problems. The required web technological infrastructure is either insufficient or does not exists in terms of web accessibility for disabled people [17]. Though, in [11] the authors found that 78.9% of the webmasters were aware that there are automatic tools to check web accessibility. This means that the missing knowledge is not the main reason for the absence of development of accessible websites. Web accessibility is particularly important since blind or color blind consumer have much more difficulty browsing the web [3]. The accessibility evaluation in e-commerce has been limited, in particular for disabled people in the context of business-to-consumer (B2C) consumer.

One new technological trend that will impact on society (and thus people with disabilities and the aged) is that of the Internet of Things (IoT)[5]. IoT is the interconnection of every physical thing (digital objects) that is networked smart devices [15]. The smart devices are able to understand, sense and respond to the environment through Internet and Radio-frequency Identification (RFID), context awareness or embedded sensors technologies [1]. This technological development of IoT enables new ways of communication between smart objects and people and between objects themselves [10][18]. It is highly desirable that e-commerce firms should make greater efforts to ensure that the consumers with disabilities have equal access to online shopping. The IoT can enable people with disabilities the support they need to attain a good quality of life and allows them to participate in social life. Therefore, the purpose of this research-in-progress paper is to analyze how people with sensory (hearing and vision), motor (limited use of hands) and cognitive (language and learning disabilities) impairments can benefit from the IoT in the context of online shopping. To the best of our knowledge, this is the first study that discusses the IoT for people with disabilities in business-to-consumer (B2C) e-commerce context.

BACKGROUND AND RELATED STUDIES
Barriers for People with Disabilities in E-commerce
The following examples may help to explain the types of barriers that can be encountered by an online consumer with a disability. For example, e-commerce websites that use flashing images could trigger symptoms for those with seizure disorders [8]. Such as the use of screen readers cannot read images, animations, navigational buttons, as well as some difficulties with reading layout tables and charts [6]. In addition, a color-blind consumer making online purchase will not differentiate the red font highlighting the discounted prices. Also, if recorded product information available to consumer on website as an audio clip. Then consumer who has difficulty in hearing or deaf cannot hear to buy the product. The website page is written in unnecessarily complicated language. Then it may present serious difficulty for consumers with language, learning or cognitive disabilities (for-example, reading disabilities, thinking, remembering, sequencing disabilities). Image interactivity technology will represent a barrier for a
consumer who cannot grip the mouse to imitate actual experiences with the product. For-example, consumers with various forms of motor impairments may have increased difficulty using a mouse or keyboard. Such as, rollovers and drop- down menus are difficult to use without a mouse.

**Internet of Things (IoT)**

The basic idea of IoT is to connect a variety of things around us to interact with each other. For-example Radio-Frequency IDentification (RFID) tags, sensors, actuators, tablets and smart phones etc. The work by [7] provided an overview of the IoT architecture for people with disabilities. It is divided into three main layers: Perception layer, Network layers and Application layer. In [12] and [14], the authors proposed systems to help visually impaired people in brick and mortar shopping for product identification and search. In addition, [23] proposed real time product detection using actual video stream. In [24] the authors discussed IoT technology applications and their integration in e-commerce inventory, logistics and online payment. In addition, industry experts agree that the IoT has a great potential to bring benefits to people with disabilities [2].

**Cloud Computing**

Cloud computing is a model for big data storage, visualization, computation and analytics etc. The integration of cloud/mobile cloud computing and IoT and has great potential for success in e-commerce. Mobile cloud computing is similar to cloud computing, where data storage takes place in the cloud through wireless networks by mobile devices [16]. Cloud Computing includes three different service models, which are Platform-as-a-Service (PaaS), Infrastructure-as-a-Service (IaaS) and Software-as-a-Service (SaaS) [16]. Cloud computing that offers utility-based model will enable businesses and users to access applications on demand anytime, anywhere and anywhere [4]. In [9], the authors proposed a cloud centric framework for worldwide implementation of IoT. The authors presented a cloud implementation using Aneka (which is based on private and public clouds interaction) to provide the capacity for utilizing the IoT.

**Electronic Product Code**

Electronic product code (EPC) has become one of the main research interests for academics and also in several industries in recent years [1]. The increasing diffusion of the EPC was first proposed by the Auto-ID Center, founded in 1999 at Massachusetts Institute of Technology (MIT) [23]. The purpose of EPC technology is to create an IoT that consist of various components (hardware and software) including open-standards to bridge the gap between the physical and virtual worlds [13]. Radio-frequency Identification (RFID) technology is a major development in the embedded communication paradigm to help in the automatic identification of anything they are attached to acting as an electronic barcode [21]. In [1], the author developed eCloudRFID framework for mobile devices to enable the development process of the integration process of EPC network instances and embedded RFID and business applications.

**ONLINE SHOPPING FRAMEWORK FOR PEOPLE WITH DISABILITIES**

People with disabilities and aged can now use improved accessibility features in smart devices (such as smartphones/tablets etc.). Many manufacturers have developed smart devices with easier user interfaces. These user interfaces enable use by disable users whose usage of smart devices may otherwise be affected by vision or hearing loss or reduced mobility. These accessible smart devices are already in use for smart cities, smart homes, smart transportation or e-health, giving disable person a new and flexible control to participate more fully in the economic environment. We propose an integrated IoT and cloud computing application to enable the creation of smart devices (such as smartphones or tablets) to be able to support a large number of disabled people for online shopping in a reliable manner. Figure 2 shows the use of IoT and Cloud computing for e-commerce. The proposed integrated cloud and IoT conceptual framework for people with disabilities is shown in Figure 3.

![Figure 2. Integrated Conceptual IoT and Cloud framework](image)

Smart devices are able to work in wireless network environments without the fear of limitations such as access devices or data sources with limited power and unreliable connectivity. In particular, we propose an iAccess service to provide the user-driven service modeling process. The cloud based iAccess service will allow disable consumer to compiles a digital shopping list of item(s) using a speech recognition or text, scanning the barcode or using RFID reader through smart device and deliver it to IoT.
The created list of item(s) is stored and registered in the service repository to be detected in the IoT cloud based service web portal. The IoT service abstracts the service modeling result to deliver to the e-commerce service platform. The web portal will display the required item to the user. Online payment can also be completed using RFID. Such as RFID chips embedded in smart devices or RFID credit cards. A conceptual framework integrating the IoT sensing devices, cloud computing and the applications is shown in Figure 3.

Figure 3. Proposed framework on online shopping scenario for disabled users

CONCLUSION AND FUTURE WORK

The main strength of the IoT is the high influence it will have on several aspects of everyday-life and behavior of disabled people. IoT creates an integral part of future Internet. On the other hand, cloud computing is a more mature technology offering several advantages. We propose a framework of the integration of IoT and cloud computing to enable great potential for success of disabled people in the context of e-commerce. The proposed framework is an environment aimed at lowering barriers for the disabled people. Increasing Internet accessibility can help to make that happen for both social and economic benefit.

F-commerce firms need to make accessibility a priority for disabled people. This study is intended as a starting point for the e-commerce firms to work together to make change for people with disabilities. Online store manager can use the proposed framework in this study to increase the chances for an online business to succeed globally with diverse degrees of Internet users. Practical implications extend to business firms to make changes to their online business strategies to trigger their online sale better by targeting consumers with disabilities.

In future work, the implementation of our proposed framework is required to ensure accessible e-commerce for people with disabilities. In addition, motivation for future work includes the development of Augmented Reality (AR) in our proposed framework on smart devices for users of all ages and with disabilities.

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INTRODUCTION OF A SMART DIET MANAGER IN IOT

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ABSTRACT
Excessive consumption leads to 7 trends of crises, including destruction of the atmosphere, energy crisis, social decline and conflicts. Over consumption also deteriorates human health. To reduce excessive consumption not only can improve health, it can also reduce transportation from consumption, livestock raise and sale, and medical care. The reducing over consumption can benefit human health and environmental protection through supply chain management. This motivates us to devise an innovative product. Our imaginative innovative product is a new smart diet manager (DM). After a survey to potential users, it reveals that the new features can help reduce the excessive consumption and deterioration of the human health as well as the destruction of environment. Enterprises can also achieve their social responsibilities through the implementation and popularization of the DM as soon as possible.

Keywords: electronic commerce, IOT, smart, Diet Manager, Consumption, Health

INTRODUCTION
With the development of the e-commerce, especially Apps, there is a big demand in the market of Apps. In the same time, excessive consumption leads to 7 trends of crises, including destruction of the atmosphere, energy crisis, social decline and conflicts [1]. Over consumption also deteriorates human health. To reduce deteriorated health due to excessive consumption, health diet has become a hot topic; more and more people focus on healthy diet habit. In reality, people are easy to purchase things that they do not need because little understanding of their needs. It leads to overconsumption and related health deterioration. Research on how mobility and social connectivity combine to produce new knowledge, business practices, and social implications is likely to become the fourth era of m-commerce in the near future [3]. That is a good opportunity to do a survey of potential users of Apps and devise a new one to satisfy possible need. To have an understanding of the market on the demand of Diet Manager (DM) and its effect on our designed App, this motivated this study. Besides, we want to study if we can be inspired from related IOT smart product-smart watch. We want to study the adherence of users to the Diet Manager App.

LITERATURE REVIEW
Digitization, networking and information are the era characteristics of the 21st century. With the rapid increasing number of mobile users, e-commerce has been in worldwide popularity and development. It provides the world with a good environment of trades and greatly facilitates the communication, save the costs of managements as well as the enterprise costs. Under this background, it would be better for the companies to find some effective ways to meet the needs of market, e.g. E-commerce.

Some studies show that expectations of accuracy, security, network speed, user-friendliness, user involvement and convenience are the most critical quality attributes underlying perceived usefulness. Regression discovered that the willingness to use depended significantly on the first five factors, which allow inter-dependencies and marginal rates of substitution between them to be estimated. Our results concentrate on demand-side changes by explaining the recent slowdown of Internet e-retail banking, which may be useful for development of planning and marketing [4][5].

Nowadays, health problem has become more and more serious. Thus, how to keep fit is also a hot topic in the world. In 1987, John Robbins published a book named” Diet for a New America”, which was an early version of food revolution. After that, he continued to work tirelessly to promote conscious food choices for more than 20 years. A suggested diet by DM is always a vegetarian which is consistent with Robbins’s book, which can improve health and protect environment.

RESEARCH METHOD
The data of Table 3 of Appendix are from the National Bureau of Statistics of the People's Republic of China. It is about the proportion of the total population of heart disease in the country. Over the past five years, the survey data from city has showed that heart diseases have become the leading cause of death, especially in women. In research, users valued two things most: notification, especially in connection with high mobility; and support for simple activities like tracking [2]. It is expected that people like smart products with notification and tracking for health status, exercise and sleep.

Thus, it motivated us to innovate a new product DM, which can effectively prevent heart disease by the way of getting people's heart rate, heart rhythm, blood pressure, sleep time, and by analyzing them, people can know their physical condition at time.
There are a lot of people who do not have routine physical examination because of certain objective or subjective reasons. The DM can help them better detect their physical condition, and prevent them from suffering diseases in time. So, this is a stylish and healthy product which can prevent heart disease and other diseases.

**Questionnaire**

Questionnaire is the most widely used method for data collection, which is feasible and effective. It is economical and timesaving. In order to testify the hypothesis effectively, the study will base on the general principles and methods of empirical research, using questionnaires to testify the theoretical construction.

With the questionnaires finished by the masses that were investigated, we can get the latest information. The questionnaire contains many aspects, including the understanding of the app, the acceptable menu of the app, the necessity of giving advice on dietary habits, the reason why they like or do not like the App, as well as the changes of people’s attitudes towards the DM.

**RESULTS**

**Data Collection**

The study used the questionnaire to collect data. And sampling is also conducted because of the limited time and energy, under the premise of the research’s objectiveness.

The research is to make an online survey to look into the development prospect of DM. And the people who were investigated are mostly among the young man in Guangdong province of China.

There is no limitation of time for participants so that they will not be nervous or strange, which can ensure the accuracy of the data.

**Sample Description**

A total of 156 questionnaires were distributed, and 156 questionnaires were gathered. The detailed content can be found in the following tables.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Sort</th>
<th>Frequency</th>
<th>Percent (%)</th>
<th>Cumulative percent (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>Male</td>
<td>61</td>
<td>39.1%</td>
<td>39.1%</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>95</td>
<td>60.9%</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td>Under 18</td>
<td>5</td>
<td>3.21%</td>
<td>3.21%</td>
</tr>
<tr>
<td></td>
<td>18–25</td>
<td>145</td>
<td>92.95%</td>
<td>96.16%</td>
</tr>
<tr>
<td></td>
<td>26–30</td>
<td>3</td>
<td>1.92%</td>
<td>98.08%</td>
</tr>
<tr>
<td></td>
<td>31–40</td>
<td>1</td>
<td>0.64%</td>
<td>98.72%</td>
</tr>
<tr>
<td></td>
<td>41–50</td>
<td>2</td>
<td>1.28%</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td>51–60</td>
<td>0</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td>Above 60</td>
<td>0</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>Age</td>
<td>Student</td>
<td>138</td>
<td>88.46%</td>
<td>88.46%</td>
</tr>
<tr>
<td></td>
<td>Office worker</td>
<td>13</td>
<td>8.33%</td>
<td>96.79%</td>
</tr>
<tr>
<td></td>
<td>Housewife</td>
<td>2</td>
<td>1.28%</td>
<td>98.07%</td>
</tr>
<tr>
<td></td>
<td>Private business employer</td>
<td>1</td>
<td>0.64%</td>
<td>98.71%</td>
</tr>
<tr>
<td></td>
<td>Free professional</td>
<td>1</td>
<td>0.64%</td>
<td>99.35%</td>
</tr>
<tr>
<td></td>
<td>Others</td>
<td>1</td>
<td>0.64%</td>
<td>100%</td>
</tr>
</tbody>
</table>

There are 61 males (39.1% of all) in the sample, and 95 females (60.9% of all). Most of the participants are aged from the age of 18 to 25, with a total of 145. The sample participants are mainly students.

There is 87.82% in total of 137 people have known and used App. Respectively, 42.95% do not have a clear understanding about the similar App with DM and 48.08% knows nothing about it. And there are 143 people have not downloaded the similar App with DM before. Mostly know the App like DM from other ways, with the percent of 41.67. The functions in DM such as setting menus, providing purchase list and the recipe all have support. 69.23% of respondents believe that set the recipe according to own physical condition is necessary. Also, 69.87% of respondents think owning DM is necessary and 95.51% have an attitude of acceptance about it. 39.74%, because of health consultation, and 29.49% learn recipes with common sense so that they choose DM. About the reason why do not choose DM, the answers such as unsatisfied with the existing electricity suppliers, cannot be sure that the
mobile electricity sup, worry about personal information leakage and afraid to spend more all have high number of votes: 22.44%, 44.23%, 58.97% and 50% respectively. There are 118 respondents hold the opinions that arrange recipes or menu according to your physical condition could help improve body function, 83 respondents think that it can help choose difficult patients. But 53.85% said that they would buy material or order according to the recipe providing by DM according to their own mood rather than say ‘yes’ like 38.46% do. 85.9% of respondents are agreed that their diets to be reused by the restaurants.

**CONCLUSION**

With the rapid development of e-commerce, App is a hot topic around the world. It covers almost every aspect of human life, such as clothing, exercising, food, and so on. So an App based on users’ individual physical condition may be feasible. This article is mainly to discuss the development prospect of DM. The following is the conclusion of the paper.

Firstly, there is a good potential growth for the diet users with available smart phone users. Secondly, there is few available App about diet. Furthermore, most people have no access to similar App before while there is a strong need for recipes. There are about 69% of all the participants have a need of customized recipes in accordance with their own physical conditions, and about 70% of all the participants think that the special customized App are necessary.

**Social Implications**

Economy, environment and community are three respects for an enterprise’s social responsibility. Since the popularization of DM, less food and energy consumption can be achieved with accompanying less environmental destruction, improved community welfare, and the enterprise’s social image. Enterprises can also achieve their social responsibility through the implementation and popularization of the DM.

**Limitations**

This article adopted statistical approach to analyze several aspects of all possibilities of DM. Meanwhile, object is mainly to one than other professional or age groups without more layers and data. People who do not have their own kitchens may be unlikely to adapt DM’s suggestions and cook for themselves. Thus, alternative survey done by people of different industries can help reduce the participants’ selection bias. Furthermore, poor medical adherence caused by poor memory or mental disorder is not included in this study. Unnecessary consumption can be reduced if this innovative human technology can be implemented and popularized as soon as possible. In this way, it can provide a good atmosphere for human health, less consumption, healthcare and transportation.

**REFERENCES**


**APPENDIX**

**Table2. About the Diet Manager**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Sort</th>
<th>Frequency</th>
<th>Percent (%)</th>
<th>Cumulative percent (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>About APP</td>
<td>Know and Used</td>
<td>137</td>
<td>87.82%</td>
<td>87.82%</td>
</tr>
<tr>
<td></td>
<td>Unknown and No Used</td>
<td>19</td>
<td>12.18%</td>
<td>100%</td>
</tr>
<tr>
<td>About the similar APP with DM</td>
<td>Know a lot</td>
<td>5</td>
<td>3.21%</td>
<td>3.21%</td>
</tr>
<tr>
<td></td>
<td>Partial understanding</td>
<td>67</td>
<td>42.95%</td>
<td>46.16%</td>
</tr>
<tr>
<td></td>
<td>Heard</td>
<td>9</td>
<td>5.77%</td>
<td>51.93%</td>
</tr>
<tr>
<td></td>
<td>Know nothing</td>
<td>75</td>
<td>48.08%</td>
<td>100%</td>
</tr>
<tr>
<td>Downloaded the similar APP with DM</td>
<td>Yes</td>
<td>13</td>
<td>8.33%</td>
<td>8.33%</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>143</td>
<td>91.67%</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td>Relatives, friends</td>
<td>33</td>
<td>39.29%</td>
<td>39.29%</td>
</tr>
</tbody>
</table>

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313
<table>
<thead>
<tr>
<th>How to know the APP(alike DM)</th>
<th>recommend</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>TV, web advertisement</td>
<td>12</td>
<td>14.29%</td>
<td>53.58%</td>
</tr>
<tr>
<td>Experts, doctors introduced</td>
<td>2</td>
<td>2.38%</td>
<td>55.96%</td>
</tr>
<tr>
<td>The pharmacy recommended</td>
<td>1</td>
<td>1.19%</td>
<td>57.15%</td>
</tr>
<tr>
<td>Other ways</td>
<td>35</td>
<td>41.67%</td>
<td>98.82%</td>
</tr>
<tr>
<td>empty</td>
<td>1</td>
<td>1.19%</td>
<td>100%</td>
</tr>
<tr>
<td>Which function is often used in DM</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Set menu</td>
<td>58</td>
<td>69.05%</td>
<td>69.05%</td>
</tr>
<tr>
<td>Provide purchase list</td>
<td>38</td>
<td>45.24%</td>
<td>114.29%</td>
</tr>
<tr>
<td>Provide the recipe</td>
<td>69</td>
<td>82.14%</td>
<td>196.43%</td>
</tr>
<tr>
<td>Set the recipe according to own physical condition</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Very necessary</td>
<td>41</td>
<td>26.28%</td>
<td>26.28%</td>
</tr>
<tr>
<td>Necessary</td>
<td>67</td>
<td>42.95%</td>
<td>69.23%</td>
</tr>
<tr>
<td>Not essential</td>
<td>46</td>
<td>29.49%</td>
<td>98.72%</td>
</tr>
<tr>
<td>No need</td>
<td>2</td>
<td>1.28%</td>
<td>100%</td>
</tr>
<tr>
<td>Owning DM</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Very necessary</td>
<td>29</td>
<td>18.59%</td>
<td>18.59%</td>
</tr>
<tr>
<td>Necessary</td>
<td>80</td>
<td>51.28%</td>
<td>69.87%</td>
</tr>
<tr>
<td>Not essential</td>
<td>42</td>
<td>26.92%</td>
<td>96.79%</td>
</tr>
<tr>
<td>No need</td>
<td>5</td>
<td>3.21%</td>
<td>100%</td>
</tr>
<tr>
<td>The attitude towards DM</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acceptable</td>
<td>149</td>
<td>95.11%</td>
<td>95.11%</td>
</tr>
<tr>
<td>Unacceptable</td>
<td>7</td>
<td>4.49%</td>
<td>100%</td>
</tr>
<tr>
<td>The reason why to choose DM</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Health consultation</td>
<td>62</td>
<td>39.74%</td>
<td>39.74%</td>
</tr>
<tr>
<td>Health monitoring</td>
<td>37</td>
<td>23.72%</td>
<td>63.46%</td>
</tr>
<tr>
<td>Learn recipes with common sense</td>
<td>46</td>
<td>29.49%</td>
<td>92.95%</td>
</tr>
<tr>
<td>Interact with other users</td>
<td>11</td>
<td>7.05%</td>
<td>100%</td>
</tr>
<tr>
<td>The reason why do not use DM</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unsatisfied with the existing electricity suppliers</td>
<td>35</td>
<td>22.44%</td>
<td>22.44%</td>
</tr>
<tr>
<td>Cannot be sure that the mobile electricity suppliers to provide the recommended quality of service</td>
<td>69</td>
<td>44.23%</td>
<td>66.67%</td>
</tr>
<tr>
<td>Worry about personal information leakage</td>
<td>92</td>
<td>58.97%</td>
<td>125.64%</td>
</tr>
<tr>
<td>Afraid to spend more</td>
<td>78</td>
<td>50%</td>
<td>175.64%</td>
</tr>
<tr>
<td>arrange recipes or menu according to your physical</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Improve body function</td>
<td>118</td>
<td>75.64%</td>
<td>75.64%</td>
</tr>
<tr>
<td>Reduce over consumption</td>
<td>37</td>
<td>23.72%</td>
<td>99.36%</td>
</tr>
<tr>
<td>Help choose difficult patients</td>
<td>83</td>
<td>53.21%</td>
<td>152.57%</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>----</td>
<td>--------</td>
<td>---------</td>
</tr>
<tr>
<td>More appetite</td>
<td>53</td>
<td>33.97%</td>
<td>186.54%</td>
</tr>
<tr>
<td>Buy materials or order according to the recipe providing by DM</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>60</td>
<td>38.46%</td>
<td>38.46%</td>
</tr>
<tr>
<td>No</td>
<td>12</td>
<td>7.69%</td>
<td>46.15%</td>
</tr>
<tr>
<td>According to the mood</td>
<td>84</td>
<td>53.85%</td>
<td>100%</td>
</tr>
<tr>
<td>Allow your diet to be reused by the restaurant</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>49</td>
<td>31.41%</td>
<td>31.41%</td>
</tr>
<tr>
<td>Free</td>
<td>85</td>
<td>54.49%</td>
<td>85.9%</td>
</tr>
<tr>
<td>No</td>
<td>22</td>
<td>14.1%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Table 3.

The number of the Chinese died from heart disease which accounts for the total quantity of dead people

![Graph showing the number of Chinese who died from heart disease over the total quantity of dead people from 2009 to 2013.]
MEASURING THE USER EXPERIENCE AND ITS IMPORTANCE TO CUSTOMER SATISFACTION: AN EMPirical STUDY FOR TELECOM E-SERVICE WEBSITES

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ABSTRACT

In telecom settings, using e-service website has become an increasingly common activity among mobile users. As an important channel, website users experience that quality plays a key role for e-service or business successes. With the use of an online structured questionnaire, a total of 20,040 were surveyed to answer the questions in thirty-one provinces in China. With methods of Principal Component Analysis, a five-factor e-service website user experience questionnaire was examined, and the factors of perceived functional completion, perceived websites performance, quality of interface and interaction, quality of content and information, and quality of online customer support or service were found effectively to measure e-service website user experience quality. In addition, all of these five aspects in e-service website user experience were found to be significant in predicting overall customer satisfaction.

Keywords: e-service websites, user experience, customer satisfaction

INTRODUCTION

E-service or commerce may refer to the conduct of service or business transactions or managerial activities using the Internet through websites or mobile applications. For individual telecom businesses, more and more people tend to select electronic channels to complete service or commerce, and this has become an increasingly common activity among mobile users. As an important channel or medium, websites play a key role for e-service or business’s success. There has been a considerable amount of research examining how to improve websites user experience, and a lot of studies recently began to focus on the e-service quality affecting customer satisfactions. However, few studies specialize in measuring user experience of e-service website in telecom field. In addition, the contribution of user experience factors to customer satisfaction when using websites to conduct individual services or commerce is not very clear, especially among telecom users in China. Combining with previous research and practical needs, this study aims to use a reliable and valid scale to measure the e-service website user experience, along with investigating its impact on customer satisfaction.

In the field of user experience, most of the studies are focused on understanding or measuring user experience in terms of dimensions and investigating how much degree does it have an impact on users’ perception on the quality of products. For example, by focusing on product perception and acceptance, Shackel in [9] defined usability or user experience in terms of effectiveness (level of interaction in terms of speed and errors), learnability (level of learning needed to accomplish a task), flexibility (level of adaptation to various tasks) and attitude (level of user satisfaction with a system); Nielsen described it as ‘the measure of the quality of the user experience when interacting with something whether a Web site, a traditional software application, or any other device the user can operate in some way or another’ [8]. With respect to user experience measuring, self-reported based survey is one of most common and useful methods to learn participants’ feedback with interacting with system [11]. For use in general, several well-known subjective usability questionnaires have been developed, including System Usability Scale [10], Software Usability Measurement Inventory (SUMI) [4][5], and Post-Study System Usability Questionnaire [6][7]. However, these questionnaires have been developed with the aim of common use for all products. Obviously, e-service websites used in telecom field differs general products or websites. In addition, web survey has become an effective and efficient way to collect user feedback in a large sample sizes. Nevertheless, how to develop a reliable web survey questionnaire with reducing respondents’ answer burden is still important [3]. Based on previous studies, a framework was proposed for understanding and evaluating user experience quality in telecom e-service website use practice. Thus, one of the aims in this study was to examine reliability of an initial e-service website user experience scale according with this framework.

The association between e-service website quality and customer satisfaction was also addressed in many previous studies. For example, [2] investigated e-service quality and its importance to customer satisfaction for e-retailing by banks. In [2], a four-factor solution of “personal needs”, “site organization”, “user-friendliness” and “efficiency” was examined to be effective factors for evaluating e-service website quality, and which was found to be a predictor of overall customer satisfaction with baking performance. The results in [2] indicated the importance of user experience of e-service website to customer satisfaction. The current study also considered the association in telecom e-service settings.

In general, by using web survey to collect respondent’s feedback in a large sample size, the aims of the current study were to 1) examine the validity and reliability of a five-factor user experience questionnaire for measuring e-service websites in telecom setting; 2) investigate how e-service website user experience quality affects customer satisfaction.
METHODS

Respondents
The data used in this study was from a web survey, which was conducted for investigating the user’s experience satisfaction toward electronic channel related products (e.g., websites, WAP, and APP), especially to study the elements which influence users’ satisfaction toward one e-commerce website. A total of 115,502 website visitors participated to answer a structured online questionnaire. With respect to assure that the responses were reliable, some basic criteria were used for the selection of valid closed-ended responses, such as those filled the same scaled scores for most or all closed items were excluded. In summary, 20,040 respondents met the requirements. Out of all these respondents, 70.8% were male and 29.2% were female. With respect to age group, 4.5% aged at 18 years or below, 32.5% aged at 19-25 years, 41.8% aged at 26-35 years, 15.6% aged at 36-45 years, and 5.5% aged at 46 years or above.

Questionnaire Measures
Being a part of the e-channels satisfaction survey, the main aim of this study was to examine the reliability of e-services website related user experience (UX) questionnaire, as well as to investigate how user experience related factors affect users’ satisfaction towards a website of e-channel. In UX practice for e-channels in telecom field, we created a user experience evaluation index. In this framework, five components or factors of UX were identified for understanding UX when using the e-channels for services checking or handling: the functional completion of the website, the performance of the website, the quality of interface or interaction of the website, the quality of content or information, and the quality of online customer service. In accordance with the framework, a panel consisting of three UX experts were required to develop a self-reported questionnaire for collecting respondent’s qualitative feedback and quantitative in web survey. With several basic criteria like the numbers of items shouldn’t be too large for reducing respondents’ response affordance, a total of 31-item survey was created after some informal tests. The questionnaire measures used in this paper consisted of the main part of this 31-item survey. Beside the demographic measures including age and gender was used in this paper, one item was used to assess the respondent’s satisfaction towards the website (“Overall, I am satisfied with use of the current website (scored 1 strongly disagree to 5 strongly agree)”) and a 16-item initial user experience scale was used in this study. As a main questionnaire in this study, the details of e-Service Websites User Experience Questionnaire was described as below.

E-service Websites User Experience Questionnaire
As mentioned above, five components in the original scale were identified for evaluating user experience for using the e-channels in telecom setting: perceived the functional completion of the website (one item was used for the evaluation), perceived the performance of the website (two items), perceived quality of interface or interaction of the website (five items), perceived quality of content and/or information (five items), and perceived quality of online customer service (three items). Table 1 includes a summary of the user experience questionnaire variables and measures used in this study. Respondents were required to score on a 5-points scale (scored 1 strongly disagree to 5 strongly agree) for each item.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Items</th>
<th>Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived the Functional Completion (PF)</td>
<td>PF1</td>
<td>The website provides all functions that I need.</td>
</tr>
<tr>
<td>Perceived the Performance of the Website (PP)</td>
<td>PP1</td>
<td>The website dose not crash, get interrupted, fail or flashed back when loading.</td>
</tr>
<tr>
<td></td>
<td>PP2</td>
<td>The Web page loading is fast.</td>
</tr>
<tr>
<td>Perceived the Quality of Interface and Interaction (PI)</td>
<td>PI1</td>
<td>The website is easy to use.</td>
</tr>
<tr>
<td></td>
<td>PI2</td>
<td>The procedures or steps were simple and clear for use like service checking and handling.</td>
</tr>
<tr>
<td></td>
<td>PI3</td>
<td>The navigation or structure in the homepage is clear, and I can use it to visit target quickly.</td>
</tr>
<tr>
<td></td>
<td>PI4</td>
<td>The interface is aesthetical.</td>
</tr>
<tr>
<td></td>
<td>PI5</td>
<td>The important functions or contents were presented well in the prominent place on the site.</td>
</tr>
<tr>
<td>Perceived the Quality of Content and Information (PC)</td>
<td>PC1</td>
<td>The important information such as charge and promotion is correct and there is no out-of-date information on the site.</td>
</tr>
<tr>
<td></td>
<td>PC2</td>
<td>The kinds of responding product (e.g., mobile terminals, cell No.) provided by the site are plentiful, and it can satisfy my demands.</td>
</tr>
<tr>
<td></td>
<td>PC3</td>
<td>The texts for introducing mobile services and promotions are clear and understandable.</td>
</tr>
<tr>
<td></td>
<td>PC4</td>
<td>I can find what I need through searching the website search.</td>
</tr>
<tr>
<td></td>
<td>PC5</td>
<td>The kinds of services provided by the site are plentiful, and it can satisfy my demands.</td>
</tr>
<tr>
<td>Perceived the Quality of Online Customer Support or Service (PS)</td>
<td>PS1</td>
<td>I can get timely reply from online customer service when I ask for helps.</td>
</tr>
<tr>
<td></td>
<td>PS2</td>
<td>The online customer service on the website can always solve my problems effectively.</td>
</tr>
<tr>
<td></td>
<td>PS3</td>
<td>The guides across different mobile service pages are designed well, and it can help me find important information that I need.</td>
</tr>
</tbody>
</table>
E-service User Experience Questionnaire Analysis

Principal Component Analysis
We first conducted a confirmatory factor analysis to confirm key components in the initial perceived user experience evaluation framework, a five-factor structure of functional completion, website performance, interface and interaction quality, content and information quality, and online support or service quality. Preliminary analysis showed no items that did not correlate with any other item or items having a correlation coefficient of > 0.9. Furthermore, the Kaiser-Meyer-Olkin statistic was more than 0.5 (0.960), and Barlett’s test of sphericity was significant ($p < 0.000$), indicating that the data was appropriate for principal component analysis [11]. We used a principal component factor analysis (PCA) to test the five dimensions in the user experience questionnaire. The PCA procedure for the scale of user experience was conducted based on total responses of 20,040 (participants) × 16 (items). With use five factors in the method of “fixed number of factors”, each item was categorized in responding component as expected, and we found the factor loading for responding items were greater than 0.5. The results were presented in Table 2.

Table 2. User experience questionnaire: item and factor loadings.

<table>
<thead>
<tr>
<th>Variables or Factors</th>
<th>Items</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived the Quality of Interface and Interaction (PI) ($\alpha = 0.864$)</td>
<td>PI1</td>
<td>0.770</td>
<td>0.213</td>
<td>0.183</td>
<td>0.197</td>
<td>0.131</td>
</tr>
<tr>
<td></td>
<td>PI2</td>
<td>0.718</td>
<td>0.255</td>
<td>0.242</td>
<td>0.153</td>
<td>0.096</td>
</tr>
<tr>
<td></td>
<td>PI3</td>
<td>0.694</td>
<td>0.321</td>
<td>0.215</td>
<td>0.158</td>
<td>0.140</td>
</tr>
<tr>
<td></td>
<td>PI4</td>
<td>0.664</td>
<td>0.210</td>
<td>0.164</td>
<td>0.217</td>
<td>0.182</td>
</tr>
<tr>
<td></td>
<td>PI5</td>
<td>0.528</td>
<td>0.516</td>
<td>0.270</td>
<td>0.149</td>
<td>0.069</td>
</tr>
<tr>
<td>Perceived the Quality of Content and Information (PC) ($\alpha = 0.841$)</td>
<td>PC1</td>
<td>0.242</td>
<td>0.754</td>
<td>0.176</td>
<td>0.195</td>
<td>-0.001</td>
</tr>
<tr>
<td></td>
<td>PC2</td>
<td>0.165</td>
<td>0.699</td>
<td>0.170</td>
<td>0.117</td>
<td>0.255</td>
</tr>
<tr>
<td></td>
<td>PC3</td>
<td>0.426</td>
<td>0.595</td>
<td>0.313</td>
<td>0.138</td>
<td>0.025</td>
</tr>
<tr>
<td></td>
<td>PC4</td>
<td>0.374</td>
<td>0.582</td>
<td>0.285</td>
<td>0.147</td>
<td>0.215</td>
</tr>
<tr>
<td></td>
<td>PC5</td>
<td>0.284</td>
<td>0.552</td>
<td>0.355</td>
<td>0.110</td>
<td>0.230</td>
</tr>
<tr>
<td>Perceived the Quality of Online Customer Support or Service (PS) ($\alpha = 0.857$)</td>
<td>PS1</td>
<td>0.226</td>
<td>0.249</td>
<td>0.832</td>
<td>0.169</td>
<td>0.101</td>
</tr>
<tr>
<td></td>
<td>PS2</td>
<td>0.245</td>
<td>0.278</td>
<td>0.823</td>
<td>0.155</td>
<td>0.116</td>
</tr>
<tr>
<td></td>
<td>PS3</td>
<td>0.425</td>
<td>0.372</td>
<td>0.565</td>
<td>0.132</td>
<td>0.152</td>
</tr>
<tr>
<td>Perceived the Performance of the Website (PP) ($\alpha = 0.705$)</td>
<td>PP1</td>
<td>0.188</td>
<td>0.166</td>
<td>0.141</td>
<td>0.852</td>
<td>0.024</td>
</tr>
<tr>
<td></td>
<td>PP2</td>
<td>0.255</td>
<td>0.171</td>
<td>0.157</td>
<td>0.771</td>
<td>0.179</td>
</tr>
<tr>
<td>Perceived the Functional Completion (PF)</td>
<td>PF1</td>
<td>0.285</td>
<td>0.255</td>
<td>0.191</td>
<td>0.168</td>
<td>0.850</td>
</tr>
</tbody>
</table>

Internal Consistency
An analysis conducted on the 16-item scale demonstrated good internal consistency ($\alpha = 0.933$). Again, preliminary analysis showed that the inter-item correlation was between $r = 0.285$ and $r = 0.759$, indicating that initial items are evidently differentiating and not redundant with one another. To check the reliability of the each variable or sub-scale (expect for perceived functional completion), internal consistency analysis (Cronbach’s $\alpha$) was conducted. In Table 2, the Cronbach’s $\alpha$ statistic for each subscale was high (0.705 or higher) and indicated reasonable inner reliability for each user experience component measured. These psychometric analyses showed that the self-report user experience measures used in this paper were valid and reliable.

Table 3. Zero-order correlations between the study variables (N = 200, 40)

<table>
<thead>
<tr>
<th>Variables</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Overall Satisfaction</td>
<td>—</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Functional Completion</td>
<td>0.546 ***</td>
<td>—</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Perceived Performance</td>
<td>0.452 ***</td>
<td>0.399 ***</td>
<td>—</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Interface and Interaction</td>
<td>0.622 ***</td>
<td>0.552 ***</td>
<td>0.544 ***</td>
<td>—</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Contents and Information</td>
<td>0.569 ***</td>
<td>0.555 ***</td>
<td>0.495 ***</td>
<td>0.771 ***</td>
<td>—</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Support or Service</td>
<td>0.544 ***</td>
<td>0.489 ***</td>
<td>0.464 ***</td>
<td>0.690 ***</td>
<td>0.729 ***</td>
<td>—</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Gender</td>
<td>0.023 **</td>
<td>0.043 ***</td>
<td>0.019 **</td>
<td>0.042 ***</td>
<td>0.054 ***</td>
<td>0.019 **</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td>8. Age group</td>
<td>0.024 **</td>
<td>0.074 ***</td>
<td>0.031 ***</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
<td>-0.078 ***</td>
<td>—</td>
</tr>
</tbody>
</table>

Note. *** $p < 0.01$; **** $p < 0.001$; ns = not significant
Correlations between the Variables

Given the possible business concerns, we did not present average values in terms of customer satisfaction and each subscale in user experience questionnaire. This did not affect the research aim of this study, which was to address the reliability and valid of the user experience questionnaire for e-service websites, and its determination effects on customer satisfaction. The overall satisfaction is higher than e-service website user experience quality; including mean scores of each subscale and overall score. Results of correlations analysis showed in Table 3 indicates that the correlations among customer satisfaction and variables of user experience were all significant. The relationships between demographic measures and user subjective response satisfaction were weak correlated.

Predictors of Customer Satisfaction: Regression Analyses

To answer the second aim of the study, a procedure of hierarchical multiple linear regression analyses was used to assess the contribution of perceived user experience measures, along with measures of gender and age group. In the hierarchical regression analyses, the five perceived user experience variables (i.e., functional completion, perceived the performance of the website, quality of interface or interaction, quality of contexts or information, and online customer support or service) were entered in step 1, the demographic measures (i.e., gender and age group) were added in step 2. By controlling the influence of other variables, this approach allowed us to assess the predictive utility of each kind of predictors. The results are summarised in Table 3. In step 1, the five perceived user experience variables were able to explain 47% of the variance in users’ satisfaction towards the website ($F$ (5, 2034) = 3539.600, $p < 0.001$), with all five variables emerging as significant predictors. In step 2, the addition of demographic variables resulted in no any increment to the variance for explaining customer satisfaction. The result suggested that gender and age groups did not emerge as significant predictors ($F$ change (2, 2032) = 1.023, $p > 0.005$). Among the five user experience variables, perceived the quality of interface or interaction emerged as the biggest contribution for predicting customer satisfaction towards the website (Beta = 0.300). The quality of content or information on the website emerged as a minor influence factor for predicting users satisfaction (Beta = 0.060), though it significantly affected customer satisfaction in statistically. In sum, the findings indicated that the user experience quality of the e-service website play a very important role in predicting address the customer satisfaction.

| Table 4. Regression analysis: predicting users’ satisfactions towards the website (N = 200, 40) |
|----------------------------------|--|--|--|--|--|--|
| Predictors                        | B   | S. E | Beta  | t    | Sig.   | 95% C.I         |
| 1. Perceived user experience measures |     |     |       |      |        |                 |
| Functional Completion             | 0.200 | 0.005 | 0.246 | 38.105 | 0.000  | 0.189-0.210     |
| Perceived Performance             | 0.088 | 0.005 | 0.104 | 16.660 | 0.000  | 0.078-0.098     |
| Interface and Interaction         | 0.300 | 0.009 | 0.296 | 33.377 | 0.000  | 0.283-0.318     |
| Contents and Information          | 0.057 | 0.009 | 0.060 | 6.525  | 0.000  | 0.040-0.074     |
| Support or Service                | 0.114 | 0.007 | 0.128 | 16.097 | 0.000  | 0.100-0.128     |
| 2. Demographic measures           |     |     |       |      |        |                 |
| Gender                           | -0.013 | 0.009 | -0.007 | -1.414 | 0.157  | -0.030-0.005    |
| Age group                        | 0.000 | 0.004 | 0.001 | 0.104  | 0.917  | -0.008-0.009    |
| R Square ($R^2$)                  |     |     |       |      |        | $R^2 = 0.469$ $[F(5, 2034) = 3539.600$, Sig. = 0.000] |

Note. 95% C.I means 95% Confidence Interval for B with lower and upper bound

DISCUSSION AND CONCLUSIONS

The aim of this study were to investigate how to measure e-service websites user experience, along with to explore the relationship between user experience factors of e-service websites and customer satisfactions. With respect to user experience questionnaire, a five-factor scale was developed. The results indicated that the aspects of e-service websites user experience in telecom differ from those for other products. In this study, the factors of perceived functional completion, perceived e-service website performance, quality of interface and interaction, quality of content and information, and quality of online support or service were examined in a large size data. As for the impact of user experience factors on customer satisfaction, this study suggested that all five user experience factors emerging as significant variables for predicting customer satisfaction. Results of correlations analysis among customer satisfaction and variables of user experience showed great significance, while that among demographic measures and user subjective response satisfaction showed weak correlation. Again, the five perceived user experience variables had explained 47% of the variance in users’ satisfaction which made it a significant predictor towards telecom e-service websites, while demographic variables meant nothing to prediction. Hence, it’s important to focus on the quality of user experience on the telecom e-service websites when predicting customer satisfaction. According to these analysis, stakeholders of e-service website could decide how to improve user experience and turn visitors into customers.

On the other hand, we found out how the user experience quality of e-service website affects customer satisfaction.

Even though we found the importance of user experience quality in predicting customer satisfaction in this research, but it still showed some limits. Firstly, as the sample is derived from one website of telecom e-service websites, generalizability of the results is limited. Although tests for reliability and validity provided initial support in this article, there still remains a possibility.
that not all e-service website were consistent with the regular pattern. Secondly, the amount of respondents’ feedback used for analysis is big, which may be easy to reach statistical significance other than variables effectively significance. The results would be used carefully.

ACKNOWLEDGEMENTS
We appreciate the partial support of this work from National Natural Foundation of China (NSFC, 31271100).

REFERENCES
MOBILE ENTERPRISE SYSTEMS, AGILITY, AND JOB PERFORMANCE: A PERSPECTIVE OF INFORMATION SCIENCE

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ABSTRACT

Despite the increasing attention paid to the information quality of mobile enterprise systems, it is still not clear how they affect job performance. This study examines mobile enterprise systems (MES) to explain how organizational workers’ perceived job performance is increased from both the organizational agility and their habitual use and mobility, while also investigating the role of information quality of MES; quality, structure, and richness. Based on the literature on agility, habitual behavior, and information quality, we proposed a comprehensive research model. Based on a large-scale survey from employees who use MES in their workplace across industries, our finding suggest that both market agility and operational agility are positively associated with perceived job performance, and such agilities are positively associated with users’ habitual use and mobility. More importantly, we also found that information quality, structure, and richness of MES are positively associated with users’ habitual use and mobility. The present findings provide us with a deeper understanding of how organizational workers utilize MES and how informational characteristics of MES affect users’ behavior and organizational agility. We discuss the implications for research and practice.

Keywords: Mobile enterprise system, job performance, agility, habitual use, information quality.
NEIGHBORHOOD OVERLAPPED PROPAGATION ALGORITHM
FOR COMMUNITY DETECTION BASED ON LABEL TIME-SEQUENCE
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Zhang Qi-shan, College of Economics and Management, China, zhang_qs@foxmail.com

ABSTRACT
The community detection algorithms based on label propagation (LPA) receive broad attention for the advantages of near-linear complexity and no prerequisite for any object function or cluster number. However, the propagation of labels contains uncertainty and randomness, which affects the accuracy and stability of the LPA algorithm. In this study, we propose an efficient detection method based on COPRA with Time-sequence (COPRA_TS). Firstly, the labels are sorted according to a new label importance measure. Then, the label of each vertex is updated according to time-sequence topology measure. The experiments on both the artificial datasets and the real-world datasets demonstrate that the quality of communities discovered by COPRA_TS algorithm is improved with a better stability. At last some future research topics are given.

Key words: Community Detection; Label Propagation; Neighborhood Topology; Label Time-sequence

INTRODUCTION OF MING THE SOCIAL NETWORKS
In a social system, individuals tend to group with others who are like-minded or with whom they interact more regularly and intensely than others. Examples include the Internet, the world-wide-web, social and biological systems of various kinds, and many others [2][21][27]. This process leads to the formation of communities. Community discovery is a classical problem in social network analysis, where the goal is to discover related groups of members such that intra-community associations are denser than the associations between communities. Furthermore, actors with interests and purposes in different fields result in overlapped communities. For instance, overlapping features can be observed in scientific collaboration networks in which scientists participate in multiple disciplines [23]. This, in fact, is quite evident today. Community detection has diverse applications including the prediction of forthcoming events, activities or developments, business intelligence, campaign management, infrastructure management, churn prediction, etc.

Generally, a community is a sub-graph of a collection of members in a social network. Many complex systems in nature and society can be described in terms of networks or graphs. Complex networks are usually characterized by several distinctive properties: power law degree distribution, short path length, clustering and community structure. The problem becomes important because complex system’s dynamics is actually determined by the interaction of many components and the topological properties of the network will affect the dynamics in a very fundamental way. A vast number of overlapping community detection methods have been developed, especially in the last few years. These include modularity based methods [7][15][22], spectral based methods [9][13][14][20] and matrix factorization based methods [10][24][28]. Matrix factorization methods such as Non-Negative Matrix Factorization (NMF) [16], can be used to classify nodes into corresponding communities. For example, Wang et al. [28] propose various NMF frameworks that can be used in overlapping community detection. Also, Zarei et al. [32] proposed a NMF-based method to detect overlapping communities using Laplacian matrix of a given network. NMF can also be used to detect communities on large networks [30]. However, the paramount drawback of such methods is, the number of communities must be known in advance, which is often not feasible.

To overcome the above mentioned challenge, several NMF-based method like, Bayesian NMF [24], Bounded Non-Negative Matrix Tri-Factorization[33] and Binary matrix factorization [19][34] have been proposed. Nodes in Bayesian NMF are classified into corresponding communities using Bayesian NMF and the number of communities present in the network is defined as the inner rank of network relation graph. Bounded Non-Negative Matrix Tri-factorization [33], uses the stated method to detect overlapped communities. Binary matrix factorization, such Symmetric Binary Matrix Factorization (SBMF) (19,20) uses optimized NMF methods on binary matrices to detect communities in the network. For instance, Zhang et al. [34] proposed an overlapping community detection method using SBMF. In SBMF [34], partition density [1] is used to compute the number of communities present in the network. Although these methods can be extended in link communities [5][12], they are still characterized by limited resolution and high computation complexity.

One of the fastest algorithms proposed to date is the label propagation algorithm (LPA) of Raghavan et al[25] well as its near-linear time complexity (for sparse networks), it is very simple and has no parameters. However, like most community detection algorithms, it can detect only disjoint communities. In this paper, we propose an algorithm that generalizes the LPA based on Time-sequence to find overlapping communities. It takes a parameter, r, which controls the potential degree of overlap between communities. The LPA is essentially a special case of the proposed algorithm with r=1.The section 3 describes the COPRA_TS algorithm.
In the sequence which is not the case in real network \[29\]. Furthermore, the method is deterministic i.e., the results are not dependent on \(t\). To find overlapped community structure. But it imposes the number of hierarchical communities. Both Refs. \[10\] and \[16\] hint at the possibility whereby \(O\) respectively, \(E\), such that each edge connects vertices \(v_i\) and \(v_j\). The value of \(n = |V|\) and \(m = |E|\) is the total number of vertices and edges respectively, that are present in a network.

**Detecting Communities By Label Propagation**

The LPA algorithm can be described very simply. Each vertex is associated with a label, which is an identifier such as an integer.

1. To initialize, every vertex is given a unique label.

2. Then, repeatedly, each vertex \(x\) updates its label by replacing it by the label used by the greatest number of neighbors. If more than one label is used by the same maximum number of neighbors, one of them is chosen randomly. After several iterations, the same label tends to become associated with all members of a community.

3. All vertices with the same label are added to one community.

The propagation phase does not always converge to a state in which all vertices have the same label in successive iterations. To ensure that the propagation phase terminates, Raghavan et al propose the use of “asynchronous” updating, whereby vertex labels are updated according to the previous label of some neighbors and the updated label of others. Vertices are placed in some random order. \(x\)’s new label in the \(i\)th iteration is based on the labels of the neighbors that precede \(x\) in the \(i\)th iteration and the labels of its neighbors that follow \(x\) in the \((i-1)\)th iteration. The algorithm terminates when every vertex has a label that is one of those that are used by a maximum number of neighbors.

The algorithm produces groups that contain all vertices sharing the same label. These groups are not necessarily connected, in the sense that there is a path between every pair of vertices in the group passing only through vertices in the same group. Since communities are generally required to be connected, Raghavan et al propose a final phase that splits the groups into one or more connected communities.

The time complexity of the algorithm is almost linear in the network size. Initialization takes time \(O(n)\), each iteration takes time \(O(m)\), and the time for processing disconnected communities is \(O(m+n)\). The number of iterations required is harder to predict, but Raghavan et al claim that five iterations is sufficient to classify \(95\%\) of vertices correctly.

Leung et al [17] have analysed the LPA algorithm in more detail. They compare asynchronous with synchronous updating, whereby the new label of each vertex in the \(i\)th iteration is always based on the labels of its neighbors in the \((i-1)\)th iteration. They found that synchronous updating requires more iterations than asynchronous updating, but is “much more stable”. They also propose restraining the propagation of labels to limit the size of communities, and a similar technique to allow detection of hierarchical communities. Both Refs. \[10\] and \[16\] hint at the possibility of detecting overlapping communities, but neither extends the algorithm to find them. COPRA [11] modified the classic LPA [17] such that each node can retain multiple labels in order to find overlapped community structure. But it imposes the number of communities a node participates in as a restriction, which is not the case in real network \[29\]. Furthermore, the method is deterministic i.e., the results are not dependent on the sequence in which the nodes are considered. This is also a problem in \[3\],[6],[8],[11],[15]. We do this in the next section.

**NEIGHBORHOOD TOPOLOGY METHOD**

**Problem Definition**

For each node \(v_i \in V\), \(N(v_i)\) is a set of all vertices adjacent to \(v_i\). In other words, \(N(v_i)\) is the neighborhood set of vertex \(v_i\), Or, \(N(v_i) = \{ v_j | (v_i, v_j) \in E \}\). The value of \(\delta(v_i)\) denotes the degree of the vertex \(v_i\). Adjacency matrix, \(A\), of a graph, \(G\), represents a relation between nodes where, \(A_{ij} = 1\), if there is an edge between \(v_i\) and \(v_j\) and \(A_{ij} = 0\) otherwise. And then let \(N_i(v_i)\) be the within community neighborhood of node \(v_i\) defined for community \(S_i \in S\) as follows: \(N_i(v_i) = \{ v_j | (v_i, v_j) \in E \land v_j \in S_i \}\). Furthermore, to measure the importance of its community \(S_i\), neighborhood connectedness is defined by FOCS\[4\] for a node \(v_j\) as the ratio of the size of its within community neighborhood to the size of its (overall) neighborhood. \(\xi_{ij} = \frac{|N_i(v_j)|}{|N(v_j)|}\) This score emphasizes on the fraction of neighborhood of node \(v_i\) that is present within the community \(S_i\).

In the COPRA\[11\] method, initially a vertex label identifies a single community to which the vertex belongs. And then it extends the label and propagation step to include information about more than one community: each vertex can belong to up to \(v\) communities, where \(v\) is the parameter of the algorithm. Alternatively, each vertex \(x\) is labeled with a set of pairs \((c, b)\), where \(c\) is a community identifier and \(b\) is a belonging coefficient, indicating the strength of \(x\)’s membership of community \(c\), such that all belonging coefficients for \(x\) sum to \(1\).

The driving principle for this paper is that communities are initiated by the interest of individuals, and influenced by their
neighbors and neighboring communities. Those that find enough common interest may choose to stay and have more connectivity. The communities then expand further as the process is iterated by the newly added ones.

### Neighborhood Overlapped Community Detection Algorithm Based on Label Time-sequence

**Initial Communities**

Initially every node $v_i$, $\forall i \in \{1,2,\ldots,|V|\}$, that has at least $K$ neighbors, builds a community $S_i$ with its neighbors. The number of communities thus is equal to the number of nodes with degree greater than $K$. In this way each node becomes a part of the communities initiated by itself and by its neighbors as well, allowing overlap between the communities at the initiation. This approach further helps a node participating in multiple communities to selectively stay in more than one community based on high connectedness scores (or leave the rest), simultaneously.

**Label Time-Sequence**

By adopting the aforementioned labels of node $v_i$ along each iteration $L_i = \{l_i, l_2, \ldots, l_t\}$, we can comprehensively use the information in the entire network. Moreover, a weight value is assigned to each node as follows. A node will choose to add its label by calculating the longest common subsequence in a social community topology. For example, as shown in the Figure 1, all of nodes around the core one have the longest common subsequence $(2, 5)$. Therefore, all of the members of this community add a new label “7” to their label sequence and reorder them by its time sequence appeared in the algorithm.

![Figure 1. The procedure of label time-sequence](image)

### Model

**Algorithm** Neighborhood Overlapped Community Detection Based on Label Time-sequence

**Input:** $G = (V, E)$: input graph, $k$: maximum common sequence allowed overlap between communities

**Output:** $S = \{S_i|S_i \subseteq V$ and $S_i$ is a community $\}$

**Auxiliary Variables:** $n = |V|$, $N(v) =$ neighbors of node $v$, $Added_i =$ Nodes added to community $S_i$ in last round

1. For each vertex $x$:
   
   old.x $\leftarrow \{x, 1\}$.

2. For each vertex $x$:
   
   Propagate($x$, old, new).

3. If id(old) $=$ id(new):
   
   min $\leftarrow$ mc(min, count(new)).

   Else:
   
   min $\leftarrow$ count(new).

4. If min $\neq$ oldmin:
   
   Old $\leftarrow$ new.

   Oldmin $\leftarrow$ min.

   Repeat from step 2.

5. For each vertex $x$
   
   Ids $\leftarrow$ id(old, x).

   For each c in Ids:
   
   If, for some m, $(c,m)$ is in coms, $(c,i)$ in sub:
   
   coms $\leftarrow$ coms - $(c,m)$ $\cup$ $(c,i)$ $\cup$ [x].

   LCS(coms, subs).

   Else:
   
   coms $\leftarrow$ coms $\cup$ [x].

   sub $\leftarrow$ sub $\cup$ [(c, Ids)].

6. For each $(c, v)$ in sub:
   
   If $i \neq 1$: coms $\leftarrow$ coms - $(c,m)$.
Experiments And Comparisons
In this section, we apply the algorithm COPRA_TS to two real-world complex networks, namely, Zachary’s karate club dataset [31] and the Dolphin social network [18]. Girvan and Newman [21] proposed the concept of modularity, which is mainly based on the assumption that a community structure is not found in random graphs. However, modularity has some trouble dealing with overlapping community structures, so Chen et al. [26] extended and then redefined it as follows:

\[
EQ = \frac{1}{2m} \sum_{i} \sum_{j} \sum_{w} \frac{1}{O(w)} [A_{vw} - \frac{k_{i}k_{w}}{2m}]
\]

In Eq. (1), \( A \) represents the adjacency matrix, \( k_{i} \) and \( k_{w} \) are the degrees of nodes \( u \) and \( v \) respectively, \( c \) is the set of all communities and \( m \) is the total number of nodes in the networks.

Experiment On Zachary’s Karate Club Dataset
Zachary’s karate club dataset is the social network of a karate club at an American university that reflects the relationship among its 34 members. The graph has 34 nodes and 78 edges. Each node represents two members of the club that frequently join activities together.

The experiment result on Zachary’s karate club dataset is shown in Table 1. We found that the community detection result derived from our proposed algorithm is the same as the COPRA algorithm. However, the speed of detecting community is much lower than the CPM.

<table>
<thead>
<tr>
<th></th>
<th>CPM</th>
<th>COPRA</th>
<th>COPRA_TS</th>
</tr>
</thead>
<tbody>
<tr>
<td>EQ</td>
<td>0.265</td>
<td>0.459</td>
<td>0.462</td>
</tr>
<tr>
<td>Time(s)</td>
<td>0.098</td>
<td>0.168</td>
<td>0.147</td>
</tr>
</tbody>
</table>

Experiment On The Dolphin Social Network
The Dolphin social network refers to the relationship formed by a group of bottlenose dolphins that live in Doubtful Sound Gulf, New Zealand. The dolphin group consists of two families. A total of 62 nodes and 159 edges are present in the network.

The experiment result on the Dolphin social network is shown in Table 2. In table 2, the new algorithm is found to improve the quality of the community. When the network is more complex, the superiority is more obvious.

<table>
<thead>
<tr>
<th></th>
<th>LAP</th>
<th>COPRA_TS</th>
<th>EQ-Increasing/%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zachary’s</td>
<td>0.3653</td>
<td>0.3762</td>
<td>2.2</td>
</tr>
<tr>
<td>the Dolphin</td>
<td>0.4770</td>
<td>0.6139</td>
<td>4.5</td>
</tr>
</tbody>
</table>

CONCLUSIONS
We have presented an algorithm, COPRA_TS, to detect overlapping communities in networks by label propagation. It is based on time-sequence of the labels propagated in every iterations condition that permits “synchronous updating”. COPRA_TS is guaranteed to terminate, and usually terminate with a good solution especially on giant networks. COPRA_TS inherits some theoretical drawbacks that the original COPRA has. We note that many the recent improvements to the LPA and COPRA may also be applicable to COPAR_TS. And it can compromise the idea of Hausdorff distance and LCS in trajectory classification in the near future.

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ON IOT IMPACT OF SUPPLY CHAIN VISIBILITY
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ABSTRACT
Supply chain visibility (SCV) is much sought after in supply chain management, yet SCV remains an intangible topic with no tangible artifacts. The on-demand visibility view required of one decision maker, the seeing role, in a supply chain is quite different to any others – context specific, and managerial varied. Data available for the view must be collected and captured by the being seen role with on-target provenance. IoT technology becomes an integrative glue in supply chain integration fabrics, facilitating on-target design with manageable end-to-end visibility. In this paper, we propose a duality SCV framework to operationalize visibility. Contributions of the paper are firstly to bring current SCV discussions into focus to how IoT technology deployment can be formulated with on-target precision by the being seen, and secondly to extend to how on-demand supply chain visibility to the seeing is enabled anywhere anytime.

Keywords: IoT, supply chain visibility, SCOR, RFID

INTRODUCTION
Visibility in supply chains is much sought after. Yet, a common approach to systemic enabling SCV is missing, notwithstanding the definition of SCV [15] [16]. With advances in IoT technologies, coupled with service-based ICT, the ability to deliver SCV with clarity and fidelity has become possible. Internet of Things (IoT) is a continuing development of interconnecting identifiable objects through networks. IoT technology brings real-time operational data to information flow, enriches and aligns the traditional transactional data pool with accuracy and currency. However, IoT and big data in general require us to rekindle how to deal with SCV, as big data is taking the data volume, velocity, variety, and veracity to a whole new dimension.

To put SCV in effect, a design will have to consider inherent properties of supply chains. In general, SCV involves two parties, the one being seen and the one seeing. Current literature often only focuses on the prior party and associates more information sharing with better supply chain performance. However, literature often does not investigate how SCV can actually benefit the latter party. Thus although SCV has been widely discussed, we posit that there is still a need to further study and define SCV. We propose a SCV conceptualization, which articulates SCV from both the seeing and being seen perspective.

In this paper, we provide a discernable understanding of visibility in the context of supply chains. We first define SCV and describe its dimensional characteristics. We then illustrate how SCV can be operationalized following a design science research approach. The artifact, a SCV IoT framework, guides how to deploy IoT technology in a supply chain with an on-target conceptual articulation. With that, a technological framework is offered to enable on-demand visibility by any participants of the supply chain at anytime and anywhere. Concluding remarks will be provided at the last section.

LITERATURE REVIEW: SUPPLY CHAIN VISIBILITY & IOT
Supply Chain Visibility
Views on SCV are varied and diverse. Wei and Wang 0 argue how information can be shared to benefit supply chain partners. Roh et al. 0 put emphasis on being able to timely access product information across the supply chain. Literature recognizes that SCV is important and is even considered as a top concern [3]. It is in general agreed that visibility of supply chain management can improve supply chain performance and drive down cost [9] 0 [22]. Yet, most companies still have very rudimentary level of visibility [4]. Surely, practitioners and academicians have a general understanding of what SCV is, but it is hard to identify what information needs to be shared and can benefit supply chain partners. Numerous studies measure SCV by the level of information sharing, extent of relationship with supply chain partners, and degree of collaboration efforts [5][7]. However, more recent studies suggest that different supply chain partners require different supply chain visibility [16] [20]. We argue that different supply chain partners require different SCV due to their contextual needs 0, as has also been suggested in the social science field 0. This concurs with seeing. The traditional SCV literature, on the other hand, mostly focuses on the being seen, as more information sharing can more likely provide context sensitive information.

Internet of Things
Current IoT implementations in supply chains are predominantly dominated by RFID technologies. A recent study showed that there is significant interest by industries to implement RFID, yet only 6% of the respondents have implemented a form of RFID [19]. Various studies illustrated that RFID can bring operational benefits [8] [21] 0. However, automating may only be a small facet of RFID benefits 0. Delen et al. 0 and Wang et al. 0 demonstrated that sharing RFID data can show even more promising benefits. It is said that by 2020, 50-100 billion things are connected to the Internet 0. IoT enables supply chains to
collect substantial amount of data to monitor operations. However, SCV for the seeing is context dependent and finding the needed data in such amount of data can be difficult. We therefore foresee that IoT can indeed help organizations to potentially gain richer SCV and in turn improve supply chain performance. However, it will be even more difficult to construct valuable SCV in the context of the seeing from the vast amount of data. We suggest that there is not only a need to define SCV in the supply chain context, but there is also a need to provide guidelines in effectively gaining SCV for industry to follow.

SCV CONCEPTUALIZATION

The proposed view on SCV differs from the traditional literature, as we do not only consider information sharing perspective, the role of being seen, but we also consider how the information is used, the role of seeing. We call this the SCV duality. The being seen is the party, who provides supply chain data and along that line we concur with the literature that more information can result into richer SCV. However, it is the seeing party, who actually utilizes the available supply chain data. We posit that the seeing role requires context sensitive SCV in order to make more informed decisions. For instance, the diminishing point of sales of a certain product can be alarming for the brand owner, whereas it may only be a mere indication for the production manager to focus on other product lines. Next we verify the SCV duality by discussing the SCV needs in end-to-end garment supply chain.

The ActiveWear Supply Chain

The authors had the opportunity to study a complete garment supply chain, which produces and sells branded garment in Asia. We will call the supply chain ActiveWear, as the supply chain has requested not to disclose its identity.

The ActiveWear brand owner operates four different menswear brands and their respective supply chain. Each brand has its own supply chain manager, yet they share most facilities, which include Fabrics Warehouse (FW), Parts Factory (PF), Garments Factory (GF) and Garments Warehouse (GW). Each brand has its own unique retail outlets in Hong Kong, Macau and China. An overall view of the supply chain is shown in Figure 1. For this study, we will only discuss one of the menswear supply chains.

We conducted several rounds of interviews with each individual supply chain partners to find out the visibility needs. Afterwards, we held brainstorm sessions with representatives from all supply chain partners to identify the major concerns of the management. The interviews suggest that information sharing among supply chain partners is not commonly practiced. This forms a stumbling block, as a delay at one of the supply chain partners can escalate to other downstream supply chain partners. The lack of information sharing was mainly due to that it is not a common practice and that the information systems were not interoperable. Information sharing is mainly practiced by placing orders with upstream supply chain partners. Although the ActiveWear supply chain partners jointly produce menswear, they operate like independent organizations and are hesitant to share information for the sake of trade secrecy. Obviously, supply chain partners will ask for the production status of their upstream partners, but this is only done periodically. For instance, the garments factory needs to monitor the parts factory in order to prevent interruptions, but only does this once at the end of each day.

Moreover, we discover issues and concerns of management due to lack of SCV through several brainstorming sessions. The lack of information sharing is causing inefficiencies in the supply chain, yet supply chain partners are unable to identify what supply chain information is needed. The supply chain partners face numerous management problems and these problems require different supply chain information to solve. Besides, not all management problems can be predefined, as ad hoc situations often arise. The brand owner realizes that the lack of SCV made the supply chain inefficient and this is a major concern, as the garment industry needs to efficient and agile in order to set and follow fashion trends.

THE IOT SCV FRAMEWORK: CONCEPTUAL & TECHNOLOGICAL

The ActiveWear case shows that SCV is lacking and very much needed for the supply chain. Discussions between the authors and ActiveWear suggested that IoT, RFID in particular, can be applied to enable SCV. In here we propose an IoT SCV...
framework with a two-phase approach, which is suitable for any given supply chain. First, a conceptual framework is developed for a discernable approach to deploy IoT technology across supply chain parties in order to capture supply chain relevant data pertinent to management issues and concerns. A technological second phase is proposed to design an IT platform to deliver context specific visibility to any user of the supply chain on-demand.

A Conceptual On-target Framework
The first phase addresses the being seen role to allow more information to be shared across the supply chain. In here we provide a conceptual framework to pinpoint clearly where IoT technology must be deployed given an understanding of current concerns of management. We term the deployment of RFID technology at locations as HotSpots. The framework has three steps as follows:

Step 1 – IDENTIFY. The goal is to critically quantify management issues and identify the possible inefficiency business processes in the supply chain.

- We identified management issues through brainstorm sessions with all senior management of all supply chain partners. We are not looking at problems of a partner, but an overall problem that could be contributing to the performance overall.
- We used SCOR (Supply Chain Operations Reference) model to chart business processes of each supply chain partner. If SCOR is used, Level 3 suffices as level of detail.
- We identified processes with the either incomplete information or missing information. We refer these business process points of interests as Target Points.

Step 2 – PINPOINT. The goal is to deploy IoT technology to capture specific data at operational checkpoints that are designed to enrich the information flow.

- With the SCOR mapping, we further extend the Target Points to Level 4 process element details, with onsite inspection and measurement.
- An IoT data schema is designed which includes the business processes, the supply chain entities involved, e.g., WIPs, and IoT data, e.g., work stations, and production order references.

Step 3 – ACTIVATE. The goal is to deploy HotSpots across all Target Points.

- The underlying IoT data flow infrastructure is designed and tested to ensure a 100% coverage.
- Install the RFID (IoT) equipment at each Target Points – each Target Point is now a HotSpot.
- Activate each HotSpot and test the effectiveness of data capture and flow.

After these steps, new real-time operational data is available for integrative processing. Along with corporate data, the seeing can have the opportunity to gain context sensitive visibility. The next artifact offers design guidelines to allow such on-demand visibility be enabled given the on-target framework which builds the operational IoT data map.

A Technological On-demand Framework
The on-demand framework provides steps to deliver context sensitive view of supply chain statuses. This on-demand visibility framework leverages current and emerging ICT to bring operational and managerial staff SCV at any volitional instance. This allows the seeing to construct SCV according to their own context at the time of need. The framework has the following three steps:

Step 1 – ONE VIEW. The goal is to present one view of supply chain for all users.

- We use SCOR “language” to present data sources in the context of these business processes.
- Data sources include both corporate and IoT data, but such distinction should only be apparent when a visibility view is presented.

Step 2 – ONE TOOL. The goal is to facilitate all users to share the same experience in creating SCV.

- A self-guided perspective for visibility information is expressed.
- With privacy and security in mind, data sources are only made available based on an access control model, e.g. role-based access control.
- A SCV view can be composed at any time when needed, which is an aspect of on-demand.
- Views can be stored, shared and modified. The construction of a view should be intuitive.
Step 3 – ONE PLATFORM. The goal is to manage visibility delivery centrally with no assumption of technology layer at data sources.

- One contact point for all, independent of the networked device they use.
- One form of presentation of visibility view is enforced.

The proposed framework is to enable users obtain data based on his/her role and location. The presentation of the view is selectable to form the visibility. Furthermore, we do not presume data as they are, but data are dynamically changing and the updated data will be dynamically updated to the users’ view. Thus SCV should be on-target and on-demand as suggested by the two-phase framework.

DISCUSSIONS & CONCLUSIONS

Scholars and practitioners in general agree that SCV is beneficial to supply chain performance. Although, we all have a presumption of what SCV is, we often still lack a well-defined understanding of SCV and how it can be applied in practice. Numerous studies associate more data with richer SCV. However, we argue that this is not always the case. We differentiate between the being seen and seeing. Being seen refers to the data owner, who shares information with their partners, which is a prerequisite for realizing SCV. Seeing refers to the one interpreting the available SCV. We argue that interpreting SCV is context specific, e.g. a retailer may appreciate point of sales data, but this may only be of little use to a production manager.

Not only did we conceptually explore SCV, but we also proposed on-target and on-demand frameworks to realize SCV. The on-target framework enables data to being shared in IoT-enabled supply chains. This framework allows each being seen to share higher fidelity data at each echelon, and as a whole brings clarity data across the supply chain. The on-demand framework allows users, seeing, to view SCV according to their own context. We argue that the current literature is still experimenting with how to deploy IoT and how it can automate manual processes. The contribution of this paper lies in how we utilized SCOR to strategically augment transactional data with operational IoT data. Moreover, we introduced an on-demand framework with the intention to make sense use of IoT data and allowing users to shape SCV according to their contextual needs.

Do note that the study only looked into RFID technology to represent IoT and care must be taken when extending it with other IoT technologies, e.g. Bluetooth Low Energy and NFC. However, RFID’s characteristics are quite similar to other sensory devices and we therefore do not foresee significant different results with other IoT technologies on a conceptual level. The differences are most likely more noticeable on a technological and implementation level. Although, we used the SCOR model to guide the framework, which allows the framework to be easily adapted to other supply chains.

This study is an initial attempt to further elucidate and articulate SCV. We understand that the quest towards SCV is an iterative process and further research is greatly encouraged. Our experience suggests that further research can be directed in the following areas:

**Cloud Computing** - It is common that technology adopted at each partner varies. Investing in IoT can be costly and may prevent smaller supply chain partners to adopt. This may leave “blind spots” in the SCV. Therefore, studies are encouraged to investigate in cloud-based approach to further lower the adoption barrier.

**IoT & Mobile Technology** - RFID technology is proven to be effective to monitor supply chain operations. Yet, RFID benefits often ends at the retail shop, as consumers do not have access to RFID equipment. Future studies could explore other IoT technologies to extend SCV to the consumers, e.g. NFC and QR code of mobile devices.

**Big Data** - We believe that big data and analytics will add another dimension to SCV. Various studies already investigate how big data affect management decisions. Future studies could explore how big data affects SCV. For instance, social media can gauge consumer sentiment, which can help supply chains to better anticipate on the consumer demand.

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ONLINE PERSONALIZATION AND INFORMATION SHARING
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ABSTRACT
Customer preference information is of great importance for vendors to carry out price discrimination and targeted marketing. Advanced Internet technologies, especially web 2.0 and web-economy, have been provided accessibility and allowed vendors to acquire these information by the user-community and online personalization technologies. This study investigates an information market where the complementary firm pays to the vendor to indirectly acquire the customer preference information, which could be costly to acquire. We develop an economic model to examine vendor’s optimal information acquisition and sharing strategies under horizontal relationship under different payment formats of the complementary firm (i.e. fixed-fee or service-rate payment). We show that both payment formats improve the basic personalization service, and the basic personalization service is equal under two payment cases, but the extra personalization service under fixed-fee payment is higher than that under the service-rate payment. Nevertheless, the vendor’s equilibrium benefits are improved with information sharing under both payment formats. Moreover, although the complementary firm would get zero benefits under fixed-fee payment and positive benefits under service-rate payment, the customer preference information can be acquired under both cases. Our findings not only help researchers interpret why the vendors implement information sharing strategies, but also assist practitioners in developing better social commerce and cooperation strategy. The implications of this paper can shed light on how firms interact under horizontal relationship where a vendor possesses information superiority.

Keywords: personalization service, information sharing, complementary firm, horizontal relationship, privacy concerns

INTRODUCTION
Complementary products are those for which a customer’s utility from using both of them together is greater than the sum of the utilities that he or she would have received from using each product separately [2]. Complementary relationships frequently arise in many industries. For example, the demands for home appliances are highly related to the home decorations. In fact, when customers buy the home appliances, the home decoration is also considered. This is because more utilities can be obtained from the combination of these two complementary products. Other examples of complementary products include the relationship between the iPhone and AT&T, computer hardware and software, etc.

It has been widely recognized that customer preference information (CPI) is of great importance for vendors. In fact, the importance of customer preference information can be reflected in two aspects. On the one hand, this customer preference information can be used to design, innovate and improve products characteristics among complementary vendors in reality and can also be applied to carry out price discrimination and targeted marketing. On the other hand, through sharing the acquired information, a vendor can strategically influence its complementary firm’s behavior [16] under horizontal relationship.

Advanced Internet technologies, especially web 2.0 and web-economy, have provided an accessibility and allowed vendors to offer online personalization (e.g. toolbars, DIY, The build-in, etc) to interact with customers to acquire CPI. Personalization, as a key interactive marketing strategy, is widely used in marketing areas. Imagine a vendor who becomes better informed of customer preference information through advanced network, user communities, online recommendation services, text mining technologies and online personalization technologies, etc. [20] [27] [41] [44] [45]. When the vendor uses the personalization service to acquire CPI for his own products, because of negligible cost of acquiring information based on these technologies, he may have the ability to simultaneously acquire this information for its complementary firm. Nevertheless, corresponding complementary firm may lack the necessary expertise and resources, and because of building a social platforms or interactive-community may bear an enormous one-time investigate which cannot afford especially for many small and medium-sized emerging enterprises. Therefore, these firms may only use the traditional acquiring technologies (e.g. E-mail, Phone, fax, etc). For instance, Haier, as a famous household appliances vendor in China, sponsors the Casarte Community (www.casarte.cn/jzxjd.php) and interacts with customers. The other example is Siemens which constructs the Built-in community (diykitche.siemens-home.cn) to acquire customer preference information. Both of communities simultaneously offer the services of home appliances and home decorations for customers. When customers participate in the community and use the personalization services, his or her preference information can be disclosed. This disclosed information includes not only the preference for household appliances (e.g. Haier or Siemens), but housing-decoration which is most important for the complementary firms (e.g. housing-decoration firm or housing-design firm). In addition, many housing-decoration firms have realized that they are less informed about this preference information than the vendor (e.g. Haier or Siemens). It is intuitive that if the vendor shares this information to its complementary firm, the extra payoff and higher satisfaction may be obtained from combination products, and that if these complementary firms acquire these preference information, R&D costs may be reduced and higher competitive advantage can be obtained. Consequently, it is wise for complementary firms to acquire this preference information shared by the vendor.
Considering the importance of customer preference information and the practice of information management under horizontal relationship, it is indispensable for firms to investigate the influence mechanism of information acquisition and sharing. However, to the best of our knowledge, few theoretical works have considered the possibility that there is an information market including a vendor who possesses information superiority and a complementary firm who lacks necessary customer preference information; that cooperation can exist between two firms under horizontal relationship; and that sharing modes may affect the firm’s acquisition strategies and benefits. Our research bridges between the theoretical and practical gap by proposing a complementary-service model. In this model, the vendor offers online personalization service to acquire customer preference information. And the complementary firm pays to the vendor to share this information. Through this model, we investigate the economic effects and payoff implications of both the vendor and the complementary firm under horizontal relationship. We address several questions that have not been analyzed in the literatures.

RQ1: How many personalization services should be offered by the vendor?
RQ2: How do patterns of payment affect the vendor’s acquisition strategies and benefits?
RQ3: Which patterns of payment should be adopted and implemented by complementary firm?

To answer these questions, we first consider two simple cases that each of firms acquires customer preference information alone. Taking these cases as the benchmark, we then investigate the case where the complementary firm pays to the vendor in two payment formats (fixed-fee or service-rate payment) to acquire preference information. In addition, under two payment formats, we respectively discuss how both payment formats affect the vendor’s acquisition strategies, in other words, how many personalization services should be offered in equilibrium, and how the strategies of payment influence the firms’ benefit. Moreover, we examine the equilibrium payoff for the complementary firm. Finally, through comparing the equilibrium results of two cases, we propose some interesting and optimal strategies for both firms.

This paper makes three main contributions. First, we have developed a simple micro-model of customer utility for personalization service and preference information. Second, we identify the information trade-off faced by a vendor and a complementary firm. Finally, we have used this model to demonstrate how the payment formats affect firm’s optimal information acquisition strategies and equilibrium benefits.

The remainder of this study is organized as follows. In §2, we review and analyze the relevant literature. We describe the model to capture the interaction between the vendor and the complementary firm in §3. In §4, we present some preliminary results. The analysis of fixed-fee payment is addressed and the effects of service-rate payment case is further discussed in §5. In §6, we discuss the limitations and management implications. The last section concludes the paper and identifies potential directions for future research. All proofs of results are elaborated in the appendix.

LITERATURE REVIEW

This study is related to the research on personalization, which have been extensively studied in recent years. The related personalization literature examines effects such as interactive marketing [32] [34] [35] [42], Customer Relationship Management [23], consumer responses and behavior [25] [21], E-commerce [5] [24] [26], user communities [44] etc. A comprehensive review of online personalization can be found in [36], which presents a framework for personalization by taking an interdisciplinary approach in the management sciences and many interesting research directions in the interactions between a firm and other key players are proposed. Under the direction of this framework, [9] starts with an empirical study on personalization versus privacy. They pointed out that customers are willing to disclose their personal information in exchange for some economic or social benefits. Considering the privacy concerns, (Chellappa 2007) uses a formal economic model to demonstrate that the entire market is better off when both privacy contracts and usage enforcement are allowed by the regulator. [10] examines vendor strategies in a market where consumers have heterogeneous concerns about privacy. [33] demonstrate how cultural and generational influences on privacy concerns empirically. [37] propose a methodology that systematically considers privacy issues by using a step-by-step privacy impact assessment. By contrast to this stream of research on privacy concerns and personalization, this study extends the literature to a horizontal relationship between a vendor and a complementary firm and theoretically investigates effects of firms’ information acquisition and sharing strategies.

This study is also closely related to the literature on information acquisition. Recently, the research of information acquisition mainly includes: economic perspective [3] [14] [15], operation research [12] [19] [30] [31], etc. Comparing these literatures of information acquisition, however, with the help of advanced network technologies (e.g. by using toolbar or sidebars to offer and design personalization services) to acquisition customer preference information is relatively new and important for management practice. Interacting with customers by effective personalization strategies, vendor not only increases its bargaining power [36], but also benefits itself through information sharing. Therefore, this study mainly focuses on online information acquisition through effective personalization technologies under horizontal relationship, to best of our knowledge, which is relatively new in the research of information acquisition.

Another closely related literature stream is information sharing. Most literatures of information sharing appear in supply chain management. For example, value [22] [28] [46], competition [18] [29], trust [38], pricing and profits [13]. Many theoretical literatures of information acquisition demonstrate the benefits between upstream and downstream in supply chain management. [16] [17] show that the downstream retailer can be hurt by information sharing, but benefit the upstream vendor in a vertical
relationship. However, there are few studies that demonstrate the information sharing under horizontal relationship. Based on the product attribute and inter-enterprise cooperation, horizontal relationship is different from the vertical relationship in supply chain. In contrast, we examine information sharing from a vendor to its complementary firm under horizontal relationship. The complementary firm may prefer to acquire information, even if it is costly, because he cannot acquire the customer preference information by himself. Moreover, we examine how information sharing affects the vendor’s information acquisition strategies and benefits.

THE MODEL

To explore the efficacy of information acquisition strategies and patterns of payment, we consider a stylized model with two players: a vendor \( M \) who provides two associated personalization services to acquire customer preference information, and a complementary firm \( C \) who pays to obtain the customer preference information from vendor’s personalization service. We intend to investigate a three-period game where the complementary firm proposes a contract for information sharing modes, then the vendor observes the contract and accepts it and determines the personalization service to offer for customers, finally the CPI can be acquired and shared to the complementary firm. In this game, customers freely use the personalization service, disclosing his or her personal and preference information under privacy concerns. We assume that both of firms are risk neutral and maximize benefits. Therefore, there are three possible scenarios as detailed below and illustrated in Figure 1.

Without loss of generality, we assume

1. Scenario 1 — Vendor offers online personalization service \( S_1 \) for customers to acquire CPI alone.
2. Scenario 2 — Complementary firm uses the traditional technologies or services \( S_2 \) to acquire CPI alone.
3. Scenario 3 — Vendor simultaneously offers personalization services \( S_1 \& S_2 \) to customers to acquire CPI. Complementary firm indirectly gets CPI from vendor offered online personalization service \( S_2 \).

Scenario 1 & 2 are similar to the advertiser-portal model in [8] in terms of personalization and privacy, but they differ in that we focus on efficacy of information acquisition strategies and patterns of payment for two players under horizontal relationship. Scenario 3 is relatively innovative to the literatures. Therefore, in order to reveal the trade-off between the vendor and complementary firm, we take the Scenario 1 & 2 as a benchmark model.

We assume Scenario 2 that is mainly based on the two considerations. On the one hand, firms build an online interactive platform, all the resources, service and management may be integrated in this huge systems and may need an enormous one-time investment which cannot afford. On the other hand, based on the consideration of complementary relationship, the complementary firm (e.g. small software enterprise and housing-decoration firm or housing-design firm), especially for many small and medium-sized emerging enterprises, can use the brand influence of vendor (e.g. Dell and Haier) to increase its competitiveness.

To describe the customers’ complementary preference, we adopt the framework of complementary products established by [11] [39]. This framework reveals quantity of demands. In our model, the vendor uses online personalization technologies to acquire CPI depending on how many such services can be offered and how much information is disclosed by customers. According to [7], this service-information mapping is given by \( g^{-1}(I) = S \), where \( I \) is customer’s preference information, \( S \) is the online personalization services and \( g^{-1}(I) \) is the current state of personalization technologies. To make the model and analysis simple, we assume a unit of information leads to a single unit service (i.e. \( I = S \)). Meanwhile, from [10], customer’s utility submits to an inverted U-shaped function in personalization service. The vendor offers two online personalization services \( S_1 \& S_2 (S_1 > 0, S_2 > 0) \). Note that the basic personalization service \( S_1 \) is used to acquire CPI for vendor himself, and the extra personalization service \( S_2 \) for complementary firm. We assume that \( P_C (P_C > 0) \) is the marginal value for personalization service and \( r_C (r_C > 0) \) is the privacy cost coefficient of customer. Thus, a customer’s utility function from using personalization service can be represented as
\[ U_C(S_1, S_2) = P_C(S_1 + S_2) - r_c(S_1^2 - KS_1 S_2 + S_2^2) \quad (1) \]

Where \( K(0 \leq K \leq 1) \) measures the degree to which personalization services are complement. If parameter \( K = 0 \), the two personalization services are independent to each other. If \( K = 1 \), the two personalization services are perfect complements. This structure of customer utility function has been widely utilized in economics, marketing, and operations management literature e.g. [1] [4] [43]. It is worth noting that the cross product \( S_1 S_2 \) represents the complementarity of two personalization services corresponding products. When vendor adds the associated personalization service into its basic service, there is spillover effect emerging from the cross-product term for the customers of combination of personalization services, which leads a higher utility for customers. This spillover effect, however, may also lead customers to disclose more customer preference information and thus induce higher privacy cost.

From the customer’s utility function (1), we calculate its bordered Hessian, due to \( 0 < K < 1 \), we have \( H = r^2(2 - K) > 0 \), and \( U_{S_i S_i} = -2r < 0 \). Therefore, there is a local maximum value in this function. Moreover, the point \((S_{1c}^*, S_{2c}^*)\) is a local maximum. Thereby, the customers’ optimal service level would be \( S_{ic}^* = \frac{P_c}{r_c(2 - K)}(i = 1, 2) \), note that ratio \( \frac{P_c}{r_c} \) which reveals a customer’s characteristic using the online personalization service and is a quantititative representation of the behavioral construct privacy calculus(see Chellappa & Shivendu, 2006) We consider a market of customers whose two ratios \( \frac{P_c}{r_c} \) for two kinds of personalization service \( S_1 \& S_2 \) are uniformly distributed, i.e. \( \frac{P_c}{r_c} \approx U[0, a] \) and \( \frac{P_c}{r_c} \approx U[0, b] \), respectively. Consequently, the two customers’ optimal service levels are specifically distributed as \( S_{1c}^* \approx U[0, \frac{a}{2 - K}] \) and \( S_{2c}^* \approx U[0, \frac{b}{2 - K}] \), respectively. Due to privacy concerns, the online personalization service levels used by customers are not more than theirs optimal levels, (i.e. \( S_{ic}^* \leq S_{ic}^* \)). In a word, a rational vendor would never offer services greater than optimal service level \( S_{ic}^* \) as no customer would find it optimal to use services beyond this level.

This study deals with customer preference information, which the vendor can acquire through personalization services and share to its complementary firm. However, complementary firm should pay to the vendor to get this useful information. The complementary firm usually chooses between two payment formats (fixed-fee or service-rate) in reality. There are numerous examples of fixed-fee & service-rate pricing for information good e.g. long-distance telephone markets, advertising expense, anonymous text markets, internet services, etc. This represents situations where the vendor has superior access to service fit customer’s preference, so the firms’ ability for information acquisition is asymmetric.

The timing of the game for a decision cycle is shown in Figure 2. In the first stage, the complementary firm provides a contract to the vendor about the formats of payment and expenses of information sharing (i.e. fixed-fee \( T \) or service-rate \( \mathcal{A} \)). Namely, the format of payment is adopted by complementary firm to get the useful CPI through the personalization service \( S_2 \) offered by the vendor. Observing the payment contract (i.e. fixed-fee & service rate) in the second stage, the vendor determines whether or not to accept the contract. If the complementary firm proposes a contract and the vendor accepts it, then the vendor should decide how many personalization services \( S_2 \) to offer to acquire the CPI for the complementary firm. Note that the vendor, on the one hand, should balance the benefit from the basic services and extra services and the cost for offering \( S_1 \& S_2 \). On the other hand, considering the complementarities of customer demands, the vendor should coordinate the two associated personalization service \( S_1 \& S_2 \) to maximize its benefit. In other words, the vendor would like to get more information disclosed by customers. Therefore, the vendor should balance both his own interests and complementary firm’s
interests in this stage and simultaneously decide the optimal personalization service level $S_1$ & $S_2$. Both firms’ benefit function will be provided in Preliminaries section. In the third stage, the vendor would share the acquired information with the complementary firm according to the contract signed in the first stage, and then the trade-off is achieved. The complementary firm may then update its belief about the customer’s demand and assess the value of acquired information. To solve the game, we use backward induction to insure sub-game perfection. A summary of the model notation is presented in Table 1.

<table>
<thead>
<tr>
<th>Notation</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>$P_C$</td>
<td>Customer’s marginal value for personalization services</td>
</tr>
<tr>
<td>$K$</td>
<td>Complementarities of two personalization service</td>
</tr>
<tr>
<td>$S_{IC}^*$</td>
<td>Optimal service level used by customers $(i=1,2)$</td>
</tr>
<tr>
<td>$r_C$</td>
<td>Customer privacy cost coefficient</td>
</tr>
<tr>
<td>$U_C(S_1, S_2)$</td>
<td>Customers’ utility from personalization service</td>
</tr>
<tr>
<td>$S_1$</td>
<td>The basic personalization service which can be used to acquire CPI for the vendor</td>
</tr>
<tr>
<td>$S_2$</td>
<td>The complementary personalization service which can be offered by the vendor and used to acquire CPI for complementary firm</td>
</tr>
<tr>
<td>$C$</td>
<td>Acquiring cost for the complementary firm by itself</td>
</tr>
<tr>
<td>$T$</td>
<td>Fixed-fee payment for the complementary firm</td>
</tr>
<tr>
<td>$\alpha$</td>
<td>Service-rate payment for the complementary firm</td>
</tr>
<tr>
<td>$\beta$</td>
<td>The vendor’s cost coefficient offering personalization service</td>
</tr>
<tr>
<td>$f(S_{IC}^*)$</td>
<td>The customer’s marginal distribution density</td>
</tr>
<tr>
<td>$S_i^N$</td>
<td>The personalization service level without information sharing $(i=1,2)$</td>
</tr>
<tr>
<td>$\Pi_M^N$</td>
<td>The vendor’s benefit without information sharing</td>
</tr>
<tr>
<td>$S_i^F$</td>
<td>The personalization service level under the fixed-fee payment $(i=1,2)$</td>
</tr>
<tr>
<td>$\Pi_j^F$</td>
<td>The firm’s benefits under the fixed-fee payment $(j=M,C)$</td>
</tr>
<tr>
<td>$S_i^V$</td>
<td>The personalization service level under service rate payment $(i=1,2)$</td>
</tr>
<tr>
<td>$\Pi_j^V$</td>
<td>The firm’s benefits under the service rate payment $(j=M,C)$</td>
</tr>
</tbody>
</table>
BENCHMARK MODELS

Before we begin the main analysis, let us consider two benchmark cases. The first one presented in Scenario 1 is that vendor offers online personalization service \( S_1 \) to customers to acquire CPI alone. The customer’s utility function is reduced as

\[
U(S_1, P) = PS_1 - rS_1^2 .
\]

In absence of personalization service \( S_2 \) (i.e. \( S_2 = 0 \)), since \( \frac{P_{1c}}{r_{1c}} \approx U[0, a] \), the optimal personalization service level used by the customer would be \( S^*_{1c} = \frac{P_{1c}}{2r_{1c}} \). Therefore, we have \( S^*_{1c} \approx U[0, \frac{a}{2}] \) and distribution density

\[
f(S^*_{1c}) = \frac{2}{a}.
\]

The vendor’s benefit function can be expressed as

\[
\pi^N_M = R_1 \left( \int_0^{S^*_{1c}} f(S^*_{1c})dS^*_{1c} + \int_{S^*_{1c}}^a f(S^*_{1c})dS^*_{1c} - \beta S^2_{1c} \right),
\]

where \( \beta \) represents vendor’s cost coefficient offering personalization service. The optimal personalization service offered by vendor would be \( S^N_{1c} = \frac{aR_1}{2R_1 + 2a\beta} \). Thus, there is no information sharing and in equilibrium the vendor’s benefit is given by

\[
\pi^N_M = \frac{aR^2_1}{4(R_1 + a\beta)}.
\]

The second benchmark case presented in Scenario 2 arises when the complementary firm acquires information through traditional service technologies \( S_2 \) (e.g. marketing surveys, purchase, developing data-mining or scientific management software packages, etc), because of building a social platforms or interactive-community may bear an enormous one-time investigate which cannot afford especially for many small and medium-sized emerging enterprises. There are two realistic and interesting awkward situations faced by between customers and the complementary firm. From a customer perspective, following the privacy calculus theory, if the utility obtained from \( S_2 \) is less than or equal to the privacy cost in this information exchange (i.e. \( U \leq 0 \)), none of customer would like to disclose the preference information to the complementary firm. Therefore, the information-service trade-off would not be arisen.

From a complementary firm perspective, if the complementary firm wants to acquire information by himself, a number of expenses should be entailed. Therefore, even though the customer preference information is very significant, the complementary firm would have to be forced to abandon acquiring information under the exorbitant costs \( C \).

As a result, we assume no information would be also acquired by the complementary firm in Scenario 2. It is also clear that from these perspectives the information value is zero for the complementary firm (i.e. \( \pi^N = 0 \)). It is wise for the complementary firm to develop new channels to acquire CPI. For example, many customers would be reluctant to disclose their preference information to one firm in real estate industries, but be willing to disclose preference information to other real estate mediums. As a consequence, considering the complementarities of products or services and the limitation of resources, the complementary firm turns to information superiority of the vendor to acquire information indirectly. This Scenario will serve as the benchmark against which compare the acquiring cost to the complementary firm’s payments (i.e. \( C > T \) & \( C > \alpha S_2 \)) to acquire customer preference information in Scenario 3.

ANALYSIS AND RESULTS

Vendor and Complementary Firm Benefits

In our model, there are no direct monetary payments from the customers. However, when customers use the personalization service offered by the vendor and disclose their preference information, the firms can derive value from this information. According to the previous studies (see Chellappa & Shivendu, 2007, 2010), customer information is acquired from two segments, the privacy seekers who are the most privacy-sensitive customers and the convenience seekers who are the least privacy-sensitive customers. To get the CPI from the vendor, the complementary firm may choose to simply pay the vendor the deterministic, pre-specified price \( T \) (\( T > 0 \)) or pay the vendor according to service-rate \( \alpha \) (\( \alpha > 0 \)). We use the superscripts \( F \) and \( V \) to denote the corresponding fixed-fee payment and service-rate payment, respectively, throughout this paper. We assume that other coefficients are common knowledge for firms.

If the vendor offers personalization service \( S_1 & S_2 \) to customers, we model the vendor and complementary firm’s benefits function in these two different cases. Under the fixed-fee payment, the vendor’s benefit can be expressed as
\[ \Pi^c_M = R_1 \left( \int_{S_1} f(S_{1c}^*) dS_{1c}^* + \frac{a}{2-K} \int_{S_1} S_1 f(S_{1c}^*) dS_{1c}^* \right) - \beta \left( S_1^2 + S_2^2 \right) + T \]

and the complementary firm’s benefit can be expressed as

\[ \Pi^c_C = R_2 \left( \int_{S_2} f(S_{2c}^*) dS_{2c}^* + \frac{b}{2-K} \int_{S_2} S_2 f(S_{2c}^*) dS_{2c}^* \right) - T \]

Under the service-rate payment, the vendor’s benefit can be expressed as

\[ \Pi^v_M = R_1 \left( \int_{S_1} f(S_{1c}^*) dS_{1c}^* + \frac{a}{2-K} \int_{S_1} S_1 f(S_{1c}^*) dS_{1c}^* \right) - \beta \left( S_1^2 + S_2^2 \right) + \alpha S_2 \]

and the complementary firm’s benefit can be expressed as

\[ \Pi^v_C = R_2 \left( \int_{S_2} f(S_{2c}^*) dS_{2c}^* + \frac{b}{2-K} \int_{S_2} S_2 f(S_{2c}^*) dS_{2c}^* \right) - \alpha S_2 \]

Where \( R_1 \) & \( R_2 \) represent the vendor and complementary firm’s marginal value for customer preference information, respectively; function \( f(S_{1c}^*) \) represents the customers’ marginal distribution density. Note that the two customers’ optimal service levels are uniformly distributed as \( S_{1c}^* \approx U[0, \frac{a}{2-K}] \) and \( S_{2c}^* \approx U[0, \frac{b}{2-K}] \), we have distribution density given by \( f(S_{1c}^*) = \frac{2-K}{a} \) and \( f(S_{2c}^*) = \frac{2-K}{b} \), respectively. Based on [40] which observes a unique feature of information goods, namely near-zero or zero marginal production cost, we assume that the vendor’s production cost for offering online personalization service is zero and \( \beta \) represents the vendor’s cost coefficient such that the net costs are quadratic convex in the total amount of services offered. These costs reveal the vendor’s cost for collecting, storing, protecting, and transmitting the information. Noting that (2) & (4), the first term represents the value the vendor derives from the information obtained collectively from the customers, where the first integral formula indicates the amount of information disclosed by the privacy-seekers and the second integral formula for convenience-seekers. The second term represents the total cost for offering the personalization service \( S_1 \) & \( S_2 \). The third term represents the extra income from the complementary firm’s payment.

We investigate how the vendor’s equilibrium acquiring strategies (i.e. \( S_1 \) & \( S_2 \)) and information benefits are influenced by the complementary firm’s payment strategies (i.e. \( T \) & \( \alpha \)). We start with the fixed-fee payment when the complementary firm pays to acquire information from the vendor. Then, we derive the vendor’s equilibrium effects under service-rate payment. In each case, we also investigate how the complementarity \( K \) and cost coefficient \( \beta \) affect the vendor and complementary firm’s benefits and the vendor’s acquiring strategies.

**Fixed-Fee Payment**

We first start analysis with the scenario 3 when the fixed-fee payment is adopted by the complementary firm to indirectly acquire CPI through the personalization service \( S_2 \) offered by the vendor. If the vendor decides to accept to acquire information for the complementary firm, how does the payment strategy (i.e. fixed-fee payment) affect the vendor’s equilibrium personalization service level and the benefits? Moreover, how are the complementary firm’s benefits and payment affected by the complementarity \( K \)? We now characterize the manufacturing and complementary firm’s optimal strategies and benefits in equilibrium as the following lemma.

**Lemma 1.** Under the fixed-fee payment, the optimal one-time fixed-fee paid by complementary firm will be

\[ T^* = \frac{bR_2^2[(2-K)R_2 + 4b\beta]}{2[(2-K)R_2 + 2b\beta]^2} \]

meanwhile, the corresponding optimal service level offered by the vendor will be

\[ S_2^* = \frac{2-K}{b} \]
can lead to spillover effect. On the contrary, the complementary firm cannot acquire the information (i.e. \( \beta \)) and decreasing in cost coefficient \( \beta \). When the complementary firm pays fixed fee payment, the spillover effect from the information sharing. Moreover, if the vendor can motivate to increase two associated personalization service levels, the vendor's equilibrium benefit will be given as

\[
S_1^F = \frac{aR_1}{(2-K)R_1' + 2a\beta}, \quad S_2^F = \frac{bR_2}{(2-K)R_2' + 2b\beta},
\]

respectively. The vendor’s equilibrium benefit will be given as

\[
\Pi_M^F = \frac{1}{2} \left( \frac{aR_1^2}{(2-K)R_1' + 2a\beta} + \frac{bR_2^2}{(2-K)R_2' + 2b\beta} \right).
\]

Lemma 1 gives us the optimal decisions of the vendor and the complementary firm under the fixed-fee payment. As the complementary firm determines the fixed-fee payment contract, the vendor observes the contract and maximizes his own profit. Therefore, on the one hand, to get the information benefit, the vendor strategically offers the basic personalization service \( S_1 \) to customers to acquire preference information; on the other hand, the vendor attempts to extract more surplus value by information sharing from the complementary firm’s payment. If the complementary firm earns negative profits from the information (i.e. \( \Pi_C^F < 0 \)), the trade-off would be ceased. Given the participation constraint, the complementary firm will set optimal fixed-fee \( T^* \) in equilibrium to indirectly acquire the CPI from the vendor.

We now turn our attention to the efficiency of acquiring strategies and two firm’s benefits under the fixed-fee payment. Comparing the benefits and personalization service level to the benchmark yields the following results.

**PROPOSITION 1.** If the fixed-fee payment can be adopted by the complementary firm, in equilibrium:

1. The personalization service \( S_1^F \) offered by the vendor is higher than that non-information sharing (i.e. \( S_1^F > S_1^N \)) and increasing in complementarity \( K \) and decreasing in cost coefficient \( \beta \).

2. The personalization service \( S_2^F \) offered by the vendor is increasing in complementarity \( K \) and decreasing in cost coefficient \( \beta \).

3. The vendor’s benefit \( \Pi_M^F \) is positive, increasing in the complementarity \( K \) and decreasing in cost coefficient \( \beta \).

4. The vendor is better off with information sharing (i.e. \( \Pi_M^F > \Pi_M^N \)).

This proposition suggests that the fixed-fee payment positively affect the vendor’s basic personalization service \( S_1^F \). This is because that to extract more fixed-fee from the complementary firm, the vendor increase \( S_1^F \) which leads to higher spillover effects and more information can be disclosed by customers. Thus the vendor can grab more surplus value from the complementary firm’s payment by information sharing. Moreover, if the vendor can motivate to increase two associated personalization service, it would influence customers to be more of convenience seekers rather privacy seekers in this customer market. In addition, the complementary firm pays fixed-fee \( T \) to the vendor for acquiring information, nevertheless, this information only stems from the personalization service \( S_2^F \) offered by the vendor and the spillover effect from the personalization service \( S_1^F \). Furthermore, the cost \( \beta \) for offering the personalization service increases, which leads both of service levels decrease. As the complementarities \( K \) of two personalization service increases, customers’ service demand also increases. Based on this observation, the vendor has a motivation to increase the two personalization service that spills over for both personalization services. Therefore, this spillover efficiency effect can be strengthened by the higher complementarity \( K \).

Proposition 1 also suggests that the vendor can benefit from information sharing. This is indicated by the difference in the complementary firm’s equilibrium fixed-fee payment between the sharing and non-sharing cases (i.e. \( \Pi_M^F > \Pi_M^N \)). Without information sharing, the vendor obtains the benefits from the information value of basic personalization service \( S_1^F \). When the vendor shares the information to the complementary firm, the fixed-fee \( T \) can be paid by the complementary firm; meanwhile, the extra personalization service \( S_2^F \) can lead to spillover effect. On the contrary, the complementary firm cannot acquire the customer preference information by itself due to high cost or limited resources showed in Scenario 2. When the complementary firm pays to the vendor and indirectly acquires information, both of firms can achieve win-win. That is, the vendor improves the benefits, and the complementary firm gets the important preference information. Therefore, we get another important result as following.

**PROPOSITION 2.** If the fixed-fee payment can be adopted by the complementary firm and the acquiring cost \( C > T^* \), in equilibrium:

1. The complementary firm’s benefit from the value of information is zero, but the customer preference information can be
acquired from the vendor.

(2) The one-time fixed-fee $T^*$ paid by the complementary firm is increasing in complementarity $K$.

When the complementary firm determines to pay the fixed-fee to the vendor for acquiring customer preference information, in equilibrium, the vendor can grab all the surplus value. That is, the complementary firm gets zero economic profits. In the game, the complementary firm, as a leader, would realize that the vendor could make a strategic decision to extract all surplus value. However, in order to acquire the information, it is inevitable that the complementary firm has to pay to the manufacture. It is because that the customer preference information, in reality, is costly to acquire. Even if spending more extra for the firms, some customers would be reluctant to disclose their preference information to firms. For example, in real estate industries, many customers would be reluctant to disclose their preference information to real estate developer, but be willing to disclose preference information to other real estate mediums. Therefore, although the information benefits are zero in this game, the complementary firm would use this preference information to design and improve its products or services, reduce R&D cost, and to carry out target marketing, etc. Compared with the benchmark, the complementary firm will obtain the customer preference information through the fixed-fee payment.

The second point of this proposition is that the fixed-fee $T$ paid by the complementary firm to acquire information is increasing with complementarities $K$ of two personalization services. That is because the extra personalization service $S^E_2$ offered by the vendor can be spilled over the basic personalization service $S^E_1$. When customers have more complementary demands for the two services, because of the mutual spillover effect, more preference information can be disclosed by customers, and thus the complementary firm should pay more to obtain this information. Therefore, the complementary firm’s fixed-fee is increasing in complementarity $K$.

Service-Rate Payment

In this section, we investigate how the service-rate payment may influence the manufacturing and complementary firm’s equilibrium behaviors and benefits. Similarly, we first provide the firm’s equilibrium strategies under the service-rate payment.

**Lemma 2.** Under the service-rate payment, the optimal service-rate paid by complementary firm will be

$$\alpha^* = \frac{2b\beta R_2}{(2 - K)R_2 + 4b\beta}.$$ 

Meanwhile, corresponding optimal service levels offered by the vendor will be

$$S^V_1 = \frac{aR_1}{(2 - K)R_1 + 2a\beta}, \quad \text{and} \quad S^V_2 = \frac{bR_2}{(2 - K)R_2 + 4b\beta}$$

respectively. The firm’s equilibrium benefit will be given as

$$\Pi^V_C = \frac{bR^2_2[(2 - K)R_2 + 6b\beta]}{2[(2 - K)R_2 + 4b\beta]^2} \quad \text{and} \quad \Pi^V_M = \frac{aR^2_1}{2[(2 - K)R_1 + 2a\beta]} + \frac{b^2\beta R^2_2}{[(2 - K)R_2 + 4b\beta]^2},$$

respectively.

When the complementary firm adopts service-rate payment to acquire customer preference information, as a leader, he knows that given an announced service-rate $\alpha^*$, the vendor will strategically maximize her own profits. Under the service-rate payment, on the contrary, the complementary firm strategically decides on the service-rate $\alpha^*$ to be paid to the vendor. However, the vendor would not only consider benefits from the service-rate payment, but also the spillover effect. Based on these characteristics, the optimal personalization service levels can be offered to customers by the vendor. From the Lemma 2, there are several important results given as follows.

**Proposition 3.** If the service-rate payment can be adopted by the complementary firm, in equilibrium,

(1) The personalization service $S^V_1$ offered by the vendor is also higher than that non-information sharing (i.e. $S^V_1 > S^N_1$), and increasing in complementarity $K$ and decreasing in cost coefficient $\beta$.

(2) The personalization service $S^V_2$ offered by the vendor is increasing in complementarity $K$ and decreasing in cost coefficient $\beta$.

(3) The vendor’s benefit $\Pi^V_M$ is positive, increasing in the complementarity $K$ and decreasing in cost coefficient $\beta$.

(4) The vendor is better off with information sharing (i.e. $\Pi^V_M > \Pi^N_M$).

Similar to the case with fixed-fee payment, the basic personalization service level $S^V_1$ offered by the vendor is higher than that.
non-information sharing case. This proposition further confirms that the payment formats can positively affect the basic personalization service level. In addition, the personalization service levels in equilibrium are increasing in the complementarity \( K \) and decreasing in cost coefficient \( \beta \). This is because as the acquiring cost \( C \) increases, the vendor’s benefits decrease. Therefore, the vendor is willing to reduce the service levels.

Proposition 3 also suggests that the vendor is better off with information sharing. This is because that the extra benefits can be paid by the complementary firm. Therefore, the rational vendor can influence its complementary firm’s behaviors by information sharing and extract its surplus value. On the contrary, there is no other way for the complementary firm to pay to obtain customer preference information. The same as the case under the fixed-fee payment, the vendor’s equilibrium benefits \( \Pi_M^V \) is related to the complementarity \( K \) and the cost coefficient \( \beta \). As the complementarity \( K \) increases, the vendor’s benefits increases. Meanwhile, as the acquiring cost increase, the vendor’s benefits decrease. Finally, comparing the vendor’s equilibrium benefits to the benchmark case, it is easy to confirm that the vendor’s equilibrium benefits under the service-rate payment are higher than the non-information sharing case (i.e. \( \Pi_M^V > \pi_M^N \)). That is the vendor is better off with information sharing.

**PROPOSITION 4.** If the service-rate payment can be adopted by the complementary firm and the acquiring cost \( C > \alpha S_2^V \), in equilibrium:

1. The service-rate \( \alpha^* \) paid by the complementary firm is increasing in complementarity \( K \).

2. The complementary firm’s benefit \( \Pi_c^V \) from the value of information is positive, increasing in complementarity \( K \); and the customer preference information can be also acquired from the vendor.

Compared with the fixed-fee payment case, two results pertaining to the effect of service-rate in information sharing emerge from this proposition. First, in contrast to the fixed-fee payment case, service-rate is also positively related to the complementarity \( K \). This is because that higher complementarity \( K \) leads to higher spillover effect and thus higher payment. As a result, the complementary firm would pay more, and get more information. Second, with the motivation of acquiring more information from the customers, it is wise to increase the service levels for the vendor and further to extract more payoff. Therefore, higher personalization service level leads to higher service-rate.

When the service-rate payment would be chosen to acquire customer preference information, the complementary firm’s equilibrium information benefits are positive and increasing in complementarity \( K \). If the complementary firm’s acquiring cost \( C > \alpha S_2^V \), he adopts the service-rate payment \( \alpha \) to indirectly acquire customer preference information from the personalization service offered by the vendor; compared with the benchmark case, the complementary firm can obtain this information as well. At the same time, the complementary firm can get positive value of information through the information sharing.

Finally, compared with the equilibrium service levels offered by the vendor and equilibrium benefit across the different payment formats cases yields the following proposition:

**PROPOSITION 5.** (1) The equilibrium personalization service level \( S_1^V \) offered by the vendor under the service-rate payment is equal to \( S_1^F \) under the fixed-fee payment (i.e. \( S_1^V = S_1^F > S_1^N \)).

(2) The equilibrium personalization service level \( S_2^V \) offered by the vendor under the service-rate payment is lower than that \( S_2^F \) under the fixed-fee payment (i.e. \( S_2^V < S_2^F \)).

(3) The vendor’s equilibrium benefit under the service-rate payment is lower than that under the fixed-fee payment (i.e. \( \pi_M^N < \Pi_M^V < \Pi_M^F \)); moreover, the equilibrium fixed-fee \( T^* \) paid by the complementary firm is higher than that under the service-rate payment (i.e. \( T^* > \alpha^* S_2^V \)).

(4) The channel’s total equilibrium benefit under the service-rate payment is higher than that under the fixed-fee payment (i.e. \( \pi_M^N + \pi_c^N < \Pi_M^V + \Pi_c^V < \Pi_M^F + \Pi_c^F \)).

Proposition 5 suggests that through comparing the two payment formats, the basic personalization service level under the service-
rate payment is equal to the fixed-rate payment case (i.e. $S_1^V = S_1^F$). This is because that the basic personalization service is used to acquire information for the vendor, but the extra personalization service for the complementary firm. Thus the payment formats cannot affect the basic personalization service levels. Note that the vendor should pay more attentions on the extra personalization service, and coordinate two associated personalization services. However, the extra personalization service level under the service-rate payment is lower than that under the fixed-rate payment (i.e. $S_2^V < S_2^F$). This is because that the basic personalization services may be only used to acquire CPI for the vendor and the extra personalization service for the complementary firm. In order to extract all surplus value of information, the vendor strategically determines the optimal extra personalization service level. Furthermore, the vendor increases benefit through adding extra personalization service into the basic personalization service, which leads spillover effects, and extracting more payoff from the complementary firm. On the contrary, the complementary firm realizes the vendor strategic behaviors and has a motivation to reduce the payment; the personalization service level offered by the vendor is decreased.

In addition, the vendor’s equilibrium benefit under the service-rate payment is lower than that under the fixed-rate payment. This is because that under the fixed-rate payment, the vendor may strategically grab all surplus value of information from the complementary firm. Moreover, the complementary firm under the fixed-rate payment should pay more than that under the service-rate payment (i.e. $T^* > T^V S_2^V$). That is why many complementary firms widely adopt the service-rate or utility-based payment to acquire information (e.g. advertising industries) in reality. Therefore, the complementary firm chooses which format of payment depending on not only the importance of CPI for producing and designing to satisfy customer’s tastes, but also the value of customer preference information for increasing benefit.

Proposition 5 further confirms that although the extra personalization service level under the fixed-rate payment is higher than that under the service-rate payment, the complementary firm under the service-rate payment not only acquires the customer preference information from the vendor’s information sharing, but also obtains a positive value of information. Consequently, the channel’s total equilibrium benefit is higher than that under the fixed-rate payment case.

**DISCUSSION AND IMPLICATIONS**

A central assumption in our model is that the complementary firm pays to the vendor to acquire customer preference information indirectly. In fact, purchasing information is wildly used by firms in reality. In this paper, we just adopt two universal payments (i.e. fixed-rate or service-rate payment) to investigate impacts of information acquisition strategies and information sharing between a vendor and a complementary firm. However, we present the acquiring cost first appeared in benchmark model which is just used to explain why the complementary firm adopts an indirect way of acquiring customer preference information from vendor. For example, in reality, because of high cost of information acquisition, many real estate developers cannot get customer preference information from customers themselves, but so many customers are willing to disclose their preference information to the real estate medium.

One implicit assumption in our model is that the preference information acquired from the extra personalization service offered by the vendor is truly and completely shared to the complementary firm. In fact, this information is usually shared depended on the trust and risk assessment in reality, the sharing modes in this paper cannot be realistic. However, although it is worth noting that the purpose of this assumption is only to simplify and streamline the mathematical analysis, it would not affect the qualitative insights. Moreover, our analysis focuses on online environments, but the model cannot be only restricted to online personalization service. In addition, in our model we propose the privacy concerns which is beyond our main analysis. On the contrary, our focus is on the impact of payment formats on the vendor’s information acquisition and information sharing strategies and the impact on the firms’ equilibrium benefits under horizontal relationship.

This study only considers the case that vendor and complementary firm are two different kinds of firms, and the vendor also has ability to acquire customer preference information through the effective personalization technologies. Therefore, another interesting issues is when the two kinds of firms have the same or different capability in acquiring customer preference information by online personalization service, whether the results showed in this paper may be different under this condition or not. This is our next step work to examine.

**Implications for Theory**

From a theoretical point of view, this study contributes to research in information sharing under horizontal relationship. Chellappa & Shivendu (2006) consider representative of portals (e.g. AOL &Yahoo) possess vast advertising and customer profiling abilities. These portals use the acquired customer preference information either to get income from advertisers or to develop online tools for targeted advertising and one-to-one marketing. Galbraith, Ghosh, & Shor (2012) examine the effect of social sharing for information goods. They point out that a firm can benefit from increased social sharing if the level of sharing is already high. Different from these literatures, we focus on the customer’s complementary demands in reality, which results in the possibilities for cooperation. Our results show that if the vendor shares the acquired information to the complementary firm, extra benefits can be obtained. Moreover, the complementary firm can get the customer preference information. The intuition supporting this solution is that no prices can be charged for personalization service, firms derive value from customer preference information.
Furthermore, this work enriches and extends the privacy calculus theory (PCT) in IS research. The broadest and most important contribution of this work is integrating customer’s privacy concerns into firm’s information acquisition decision. Such integration is a key contribution and way to advance science. Li (2012) reviews fifteen established theories in online information privacy research. Smith & Dinev (2011) review the information privacy research by an interdisciplinary perspective. Pavlou (2011) evaluates the current state of the IS literature on information privacy (where are we now?) and identifies promising research directions for advancing IS research on information privacy (where should we go?). These researches point out that information privacy refers to the concept of controlling how one’s personal information is acquired and used. When customers disclose information to the firms, an individual’s intention is based on a calculus of behavior which is the risk-benefit analysis, where the trade-offs between expected risks and expected benefits are considered within a specific information-disclosure context. Based on the privacy calculus theory, we build a simple micro-model of customer utility for personalization service and preference information, which can be used to reveal benefit-risk relationship between customers’ information disclosure and privacy concerns. Our study shows that the vendor may balance and coordinate the two associated personalization services to lead customers disclosing more information. The customer, however, would strategically use the personalization service offered by the vendor and disclose information under privacy concerns.

In sum, this study examines the benefits of information sharing under horizontal relationship and demonstrates the importance of PCT in IS research, increases our understanding of sharing strategies and user-adopt and behaviors, and contributes to the growing body of research on online personalization and privacy concerns.

**Implications for Practice**

Several managerial implications result from our analyses. Firstly, our findings show that the vendor is better off with information sharing under two payment formats. Because of the complementary demands, the customer disclosed information is important for both the vendor and its complementary firms. If the vendor, as an only information superiority side, shares partial information to its complementary firm, she can obtain extra payment and thus increase benefits. Therefore, the economic force underlying this result conveys that the vendor has a motivation to share information acquired from customers to the complementary firm. Secondly, the vendor can strategically influence the complementary firm’s behavior (e.g. free-riding). Through information sharing, the vendor may filtrate cooperative partner, and thus extract economic payoff from the complementary firms. In the contrary, in order to get competitiveness and reduce market uncertainty, it is wise for the complementary firm to acquire information indirectly from its partner. Thirdly, this study points out that the service-rate payment is an optimal strategy for the complementary firm. That is because the complementary firm not only obtains the customer preference information, but also gets a positive benefits from this information. This result is consistent with Sundararajan (2004), which points out that if the marginal cost component does not exist, then a fully revealing, purely usage-based contract becomes optimal. Therefore, this result also provides a basis for the complementary firm who chooses the format of payment.

**CONCLUSIONS AND FUTURE WORK**

In this paper, we theoretically investigate the impact of modes of information sharing on the firm’s equilibrium acquisition strategies and benefits under horizontal relationship. Two payment formats (i.e. fixed-fee or service-rate payment) for information sharing are identified. We present several interesting results that provide management insights into information interaction between the complementary firms in markets characterized by complementary demands, strategies of information acquisition, and information sharing.

First, this paper demonstrates that although both personalization services, in equilibrium, are higher than that in benchmark case, basic personalization service level is equal to that under two payment formats. Moreover, the extra personalization service level under the fixed-fee payment is higher than that under the service-rate payment case. This suggests that the vendor should be more cautious in balancing two levels of personalization service and make efforts to coordinate the extra personalization service for acquiring more information disclosed by customers and thus extract more payoffs from the complementary firm. In other words, in order to ensure to acquire a given amount of information from the basic personalization service, the vendor should balance the extra personalization service level to acquire information for the complementary firm and extract payoff to improve its benefits.

In addition, this study shows that the vendor is better off with information sharing under two payment formats. The economic force underlying this result conveys that the vendor has a motivation to share information acquired from customers to the complementary firm. It is important to emphasize that, on the one hand, the vendor’s benefits can be increased by information sharing; on the other hand, the vendor can strategically influence the complementary firm’s behavior (e.g. free-riding) [16]. For example, because of the complementarity of preference, many complementary firms have the opportunistic behaviors to reduce cost. As a result, although our focus here is the observability of the benefits of information sharing, the conceptual insights of this paper can be extended to more general situations when the cost and risk of information sharing cannot be neglected under horizontal relationship.

The above insights provide prescriptions on how vendor should respond to changes in information acquisition and in information sharing arrangement. Under the fixed-fee payment, although all the value of information can be extracted by the vendor, the preference information would be acquired. Under the service-rate payment, the complementary firm can get the positive value of
information and obtain the customer preference information. Such theoretical insights suggest that to obtain the customer preference information, the complementary firm may find new channels and cooperative partners. With the help of cooperative partners’ information superiority, the complementary firm can get useful information and increase competitiveness.

One direction for future research would be to consider other coordination mechanism that could be used to coordinate two personalization services offered by the vendor; meanwhile, other information sharing mechanism that the vendor decides when and how much information would share to the complementary firm. Another direction in which our study could be extended would be to relax the assumption that the characteristic of customers are uniformly distributed. Any other general distribution would be investigated, which would be more true under the reality circumstances.

APPENDIX.

PROOFS OF LEMMAS AND PROPOSITIONS

Simplifying equation (2)-(5), we get

\[
\begin{align*}
\Pi_M^f &= R_i \left( S_1 - \frac{(2-K)S_1^2}{2a} \right) - \beta \left( S_1^2 + S_2^2 \right) + T \\
\Pi_C^f &= R_2 \left( S_2 - \frac{(2-K)S_2^2}{2b} \right) - T \\
\Pi_M^v &= R_i \left( S_1 - \frac{(2-K)S_1^2}{2a} \right) - \beta \left( S_1^2 + S_2^2 \right) + \alpha S_2 \\
\Pi_C^v &= R_2 \left( S_2 - \frac{(2-K)S_2^2}{2b} \right) - \alpha S_2
\end{align*}
\]

**Proof of Lemma 1:** Due to the complementary firm proposes a contract, if the vendor accepts it and thus has a motivation of extracting all surplus value from complementary firm. Therefore, in equilibrium, the value of information obtained by the complementary firm is zero. That is, the fixed-fee is equal to the value of information. Otherwise, note that complementary firm’s profit function satisfies \( \Pi_C^v \geq 0 \), if the vendor wants to grab more surplus profit, complementary firm would discontinue the trade-off. We substitute the value of information (i.e. fixed-fee) in the vendor’s benefit function given by (6). Differentiating equation (6) and getting the FOC equal to zero, we get the two optimal personalization service level of the vendor under fixed-fee payment:

\[
S_1^f = \frac{aR_i}{(2-K)R_i + 2a\beta}, S_2^f = \frac{bR_2}{(2-K)R_2 + 2b\beta},
\]

respectively. Substituting these optimal personalization service levels in the complementary firm profit function given by equation (7), we get the optimal fixed-fee of the complementary firm

\[
T^* = \frac{bR_2^2[(2-K)R_2 + 4b\beta]}{2[(2-K)R_2 + 2b\beta]^2}.
\]

Then, substituting these optimal values in equation (6), we get the vendor’s optimal profits as

\[
\Pi_M^f = \frac{1}{2} \left( \frac{aR_i^2}{(2-K)R_i + 2a\beta} + \frac{bR_2^2}{(2-K)R_2 + 2b\beta} \right).
\]

**Proof of Proposition 1:** (1) Note that \( S_1^f - S_1^N = \frac{aR_i}{(2-K)R_i + 2a\beta} - \frac{aR_i}{2R_i + 2a\beta} > 0 \), we can get \( S_1^f > S_1^N \). By differentiating \( S_1^f \) with respect to \( K \) and \( \beta \), we have \( \frac{\partial S_1^f}{\partial K} = \frac{aR_i^2}{[(2-K)R_i + 2a\beta]^2} > 0 \), and \( \frac{\partial S_1^f}{\partial \beta} = -\frac{2a^2R_i}{[(2-K)R_i + 2a\beta]^2} < 0 \). We can prove that \( S_1^f \) is increasing in \( K \) and decreasing in \( \beta \). (2) Similarly, by differentiating \( S_2^f \) with respect to \( K \) and \( \beta \), respectively, \( \frac{\partial S_2^f}{\partial K} = \frac{bR_2^2}{[(2-K)R_2 + 2b\beta]^2} > 0 \), and \( \frac{\partial S_2^f}{\partial \beta} = -\frac{2b^2R_2}{[(2-K)R_2 + 2b\beta]^2} < 0 \), we can verified that \( S_2^f \) is increasing in \( K \) and decreasing in \( \beta \). (3) By differentiating \( \Pi_M^f \) with respect to \( K \) and \( \beta \), respectively, it is easy to confirm that the vendor’s benefits is increasing in \( K \) and decreasing in

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\( \beta \). (4) Comparing the benchmark, it is easy to verify \( \Pi_M - \pi_M^N > 0 \). □

**Proof of Proposition 2:** By differentiating equation \( T^* \) respect to \( K \), we get
\[
\frac{\partial T^*}{\partial K} = -\frac{bR_1[(2-K)R_2 + 6b\beta]}{[(2-K)R_2 + 2b\beta]^2} < 0.
\]

We have that the fixed-fee \( T^* \) paid by the complementary firm is decreasing in complementarity \( K \). From the Lemma 1, it is easy to indicate that in equilibrium the complementary firm gets zero profit or surplus. It is because that all surplus value can be grabbed by the vendor. □

**Proof of Lemma 2:** By differentiating equation (8) with respect to \( S_1 \) and \( S_2 \), respectively, and letting the first-order condition equal to zero, we get the reaction function of the vendor for a paid service rate \( \alpha \) by the complementary firm
\[
S_1^V = \frac{aR_1}{(2-K)R_1 + 2a\beta} \quad \text{and} \quad S_2^V(\alpha) = \frac{\alpha}{2\beta},
\]
respectively. Then, substituting \( S_2^V(\alpha) \) in equation (9) and differentiating with respect to \( \alpha \), we set the first-order condition equal to zero, we get optimal service rate as \( \alpha^* = \frac{2b\beta R_2}{(2-K)R_2 + 4b\beta} \). We substitute this optimal service rate in the reaction function, the optimal personalization service level can be
\[
S_2^V = \frac{bR_2}{(2-K)R_2 + 4b\beta}.
\]
Therefore, the vendor’s and the complementary firm’s optimal benefits can be given by
\[
\Pi_c^V = \frac{bR_2^2[(2-K)R_2 + 6b\beta]}{2[(2-K)R_2 + 4b\beta]^2}, \quad \text{and} \quad \Pi_m^V = \frac{aR_1^2}{2[(2-K)R_1 + 2a\beta]} + \frac{b^2\beta R_2^2}{[(2-K)R_2 + 4b\beta]^2}. \quad \Box
\]

**Proof of Proposition 3:** (1) Comparing the Lemma 2 and benchmark, \( S_1^V - S_1^N = \frac{aR_1}{(2-K)R_1 + 2a\beta} - \frac{aR_1}{2R_1 + 2a\beta} > 0 \), it is clear that in equilibrium \( S_1^V \) is higher than \( S_1^N \). Similar as Proposition 1, it is clear that \( S_1^V \) is increasing in \( K \) and decreasing in \( \beta \).

(2) Differentiating \( S_2^V \) w.r.t. \( K \) & \( \beta \), we have that
\[
\frac{\partial S_2^V}{\partial K} = \frac{bR_2^2}{[(2-K)R_2 + 4b\beta]^2} > 0, \quad \frac{\partial S_2^V}{\partial \beta} = -\frac{4b^2\beta R_2}{[(2-K)R_2 + 4b\beta]^2} < 0.\]

It is obvious that \( \Pi_m^V > 0 \), and \( \Pi_c^V \) is increasing in \( K \) and decreasing in cost coefficient \( \beta \). (4) Comparing the benchmark, we have that \( \Pi_m^V - \pi_m^N = \frac{aR_1^2}{2[(2-K)R_2 + 4a\beta]} + \frac{b^2\beta R_2^2}{4(R_1 + a\beta)} > 0 \). □

**Proof of Proposition 4:** (1) Differentiating \( \alpha^* \) with respect to \( K \), we have that
\[
\frac{\partial \alpha^*}{\partial K} = \frac{2b\beta R_2^2}{[(2-K)R_2 + 4b\beta]^2} > 0.
\]

From Lemma 2, by differentiating \( \Pi_c^V \) w.r.t. \( K \), we get that
\[
\frac{\partial \Pi_c^V}{\partial K} = -\frac{bR_1[(2-K)R_2 + 8b\beta]}{[(2-K)R_2 + 4b\beta]^2} < 0.\quad \Box
\]

**Proof of Proposition 5:** From the Lemma 1 and Lemma 2, we can easily verify that
\[
S_2^V - S_2^N = \frac{bR_2}{(2-K)R_2 + 2b\beta} - \frac{bR_2}{(2-K)R_2 + 4b\beta} > 0.
\]
\[
\Pi_m^V - \Pi_m^N = \frac{bR_2^2}{2[(2-K)R_2 + 2b\beta]} - \frac{b^2\beta R_2^2}{[(2-K)R_2 + 4b\beta]^2}
\]
\[
> \frac{bR_1^2[(2-K)R_2 + 4b\beta] - 2b^2\beta R_2^2}{2[(2-K)R_2 + 4b\beta]^2} = \frac{(2-K)bR_3^1 + 2b^2\beta R_2^2}{2[(2-K)R_2 + 4b\beta]^2} > 0.
\]
T^* - \alpha^* S^*_V = \frac{bR^2_2[(2-K)R_2 + 4b\beta]}{2[(2-K)R_2 + 2b\beta]^2} - \frac{4b^2\beta R^2_2}{2[(2-K)R_2 + 4b\beta]^2}.

\frac{(2-K)bR^3_2}{2[(2-K)R_2 + 4b\beta]^2} > 0

\Pi^V_M + \Pi^V_C - \Pi^F_M - \Pi^F_C = \frac{bR^2_2[(2-K)R_2 + 8b\beta]}{2[(2-K)R_2 + 4b\beta]^2} - \frac{bR^2_2}{(2-K)R_2 + 2b\beta}

= \frac{b^2\beta R^2_2}{2[(2-K)R_2 + 2b\beta][(2-K)R_2 + 4b\beta]^2} > 0

\Pi^F_M + \Pi^F_C - \pi^N_M - \pi^N_C = \frac{1}{2} \left( \frac{aR^2_1}{(2-K)R_1 + 2a\beta} + \frac{bR^2_2}{(2-K)R_2 + 2b\beta} \right)

- \frac{aR^2_1}{4(R_1 + a\beta)} > \frac{aR^2_1}{2[(2-K)R_1 + 2a\beta]} - \frac{aR^2_1}{4(R_1 + a\beta)} > 0

Therefore, we have \pi^N_M + \pi^N_C < \Pi^V_M + \Pi^V_C < \Pi^F_M + \Pi^F_C.

REFERENCES


OPPORTUNITIES AND IMPACTS OF ADDITIVE MANUFACTURING: A LITERATURE REVIEW

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ABSTRACT
Additive manufacturing industry has experienced tremendous growth in the last decade. This paper aims to address the lack of insights and systematic research by investigating opportunity and impact of potential economic benefits of AM. Our results show that the number of publications in the AM research has increased exponentially since 2009. The papers have been identified into five themes: applications, country, opportunity, economics and social. Our results show that there are an increasing number of papers that investigate economic and social benefits of AM.

Keywords: Additive manufacturing, 3D printing

INTRODUCTION
Additive manufacturing (AM) or 3D printing is a process of joining materials to make objects from 3D model data [35]. The object is created through successive layers of materials using computer-generated design to reproduce a digital model through consolidation of materials with an energy source [19, 36, 43]. Petrick and Simpson [36] argue that AM environment allows consumers to interact directly with producers in a manner that economies of scale and high volume centralised production is no longer necessary. In fact AM results in localisation of both production and sourcing. AM is viewed as a disruptive technology that has the potential to replace conventional manufacturing processes [40] and the AM industry is projected to increase from $3.07 billion in 2013 to $12.8 billion by 2018 [13]. The advantages of AM include low-volume production, lower cost production, responsive production, shorter supply chains, democratisation of production and optimised design [40]. AM was initially used for rapid prototyping purposes, however there have been greater number of finished products (such as biomedical implants, pharmaceutical products, customised sport gears) produced in the last few years.

The expansion and growth of AM industry in recent years have resulted in extensive publications in the research area of AM. However publications in AM have focused on the engineering and technical development aspect of AM technology such as selective laser sintering and dynamic magnetic compression. Little research has presented an overview of potential economic and social impacts of AM. This paper aims to address the lack of insights in this direction. A systematic search is conducted to identify publications that investigate or research into potential and opportunities of AM as disruptive technology in the society. This paper presents the outcome of a preliminary systematic literature search in AM.

METHOD
A literature search was conducted in September 2015 using three databases: ProQuest, Web of Science and Scopus. AM was initially used for rapid prototyping purposes and it was around the period of 2000s that AM has begun to grow. Thus the time limits of literature search were set to the years from 2000 to 2015. Search terms were based on title of publication that consists of (“additive manufacturing” OR “3D printing”) and keywords with “opportunities” OR “opportunity”. The reason keyword “opportunity” or “opportunities” is selected is to identify papers that report AM as an instrument for opportunity for adoption. Only peer-reviewed and full-text articles written in English are included. As this paper aims to identify research that presents promises and assessing impacts and potential use of AM, only articles that presents survey of current practices, adoption, opportunities, innovation, economy and social benefits of AM are included. Articles that describe AM from the engineering or technological development perspective such as selective laser sintering, dynamic magnetic compression, computer-aided design (CAD), 3D handling software and detailed AM production processes such as in tissue regeneration [12], biomedical implant [23, 45] were excluded. Content analysis was conducted by reviewing the abstract of articles to ensure it fits this criterion. Full-text of papers was reviewed if the abstract did not present sufficient information to determine if the paper meets the inclusion criteria. Figure 1 shows the process flow of the search strategy.

![Database search (Proquest, Scopus & Web of Science) 751 records identified](image1.png)

![Remove duplicates 703 records identified](image2.png)

![Review abstract to meet inclusion criteria 35 records identified](image3.png)

Figure 1. Process flow of the search strategy.
RESULTS

A total of 751 records were identified from the three databases. There were 703 records after duplicated records were removed. Figure 2 shows the distribution of papers between 2000 and 2015. It is worth noting that the number of records found for 2015 only shows records up to the current search date September 2015. From the graph, it can be seen that from the year 2009 there was an extensive increase in the number of papers published in area related to AM. The abstracts of 703 records were further reviewed to find articles that met the inclusion criteria specified in the search strategy. Of these 35 records were found. Figure 3 shows the distribution of papers that met the criteria between 2000 and 2015.

![Figure 2. Distribution of records - initial search](image)

![Figure 3. Distribution of records that met the inclusion criteria](image)

Each of the 35 papers was reviewed and each paper is identified into a theme. Five themes were proposed: applications, country, opportunity, economics and social. The applications theme identified papers that discuss the applications of AM such as aerospace, health and medical, food and archaeological restoration. Papers in the country theme report on how AM is used in a specific country. The opportunity theme refers to papers that present findings on insights, ideas, potential and impact of AM. Papers identified in the economics theme presents findings on economic or business models, costing models and supply chain of AM. The social theme includes papers that investigate privacy, intellectual property and environmental impact of AM. Table 1 shows the references identified for each of the themes.

<table>
<thead>
<tr>
<th>Theme</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applications</td>
<td>Angrish et al. [2], Banerjee et al. [5], Ferreira et al. [18], Harrysson et al. [24], Li et al. [30], Lipton et al. [31], Soe et al. [41], Yeong et al. [49]</td>
</tr>
<tr>
<td>Country</td>
<td>Bhattacharjya et al. [7], Campbell et al. [10], de Beer [16], Kianian et al. [27], Rahim et al. [38], Wong [48]</td>
</tr>
<tr>
<td>Opportunity</td>
<td>Ahuja et al. [1], Campbell et al. [9], Gress et al. [21], Ma [33]</td>
</tr>
<tr>
<td>Economics</td>
<td>Atzeni et al. [4], Campbell et al. [11], Cozmei et al. [14], Dawes et al. [15], Khajavi et al. [25], Liu et al. [32], Mellor et al. [35], Piller et al. [37], Weller et al. [47]</td>
</tr>
<tr>
<td>Social</td>
<td>Appleyard [3], Bem et al. [6], Burkhart et al. [8], Forrest et al. [20], Kietzmann et al. [28], Kurfess et al. [29], Mani et al. [34], Valpreda [44]</td>
</tr>
</tbody>
</table>
DISCUSSION

The AM industry has experienced tremendous growth in the last decade with the global markets for AM products and services has grown to over $2 billion [40]. Extensive research has been reported on engineering and technological challenges to improve materials used, machine speed, CAD programs and product reliability. Limited research reports on potential, opportunities and assessing impacts of the use of AM on society at large. Results from literature search show that the number of publications in the AM research has increased exponentially since 2009, however most of the published papers are focusing on the engineering and technical perspectives. Of the 703 articles retrieved, only 5% of the papers discuss potential and opportunity of AM in a wider community. Of the 35 papers reviewed, there are an increasing number of papers that investigate economic and social benefits of AM in relation to improved product value [11], social inclusion [6] and job creation [27]. The impact of AM on supply chain has also been explored [15, 25] and the benefits of AM in other sectors (besides engineering and manufacturing) has also been presented. For example there is an increasingly positive impact of AM in medical application [5, 24]. The economic impact of AM at firm [4], industry [10] and country [20] levels are reported. Social and environment issues such intellectual property [28, 29] and environmental impact [34] are also being reported.

AM has its roots in the development of rapid prototyping in the 1980s with technology advances in stereolithography. Then advancement in processes such as laser sintering and material deposition extrusion in the early 1990s has resulted in AM technology being used in more sectors and demands for applications began to grow. Within the last five years, advances in new material and improved AM processes through development of new generation of 3D printers have resulted in AM gain popularity as the technology matures. Industry from different sectors have realised the potential of using AM to further develop their own products to enable cost savings and new optimized designs. As AM progresses, the future of AM will gain widespread practices.

One of potential impact of AM that has been reported is in reshoring. Many manufacturing firms in the developed countries such as America and United Kingdom have begun to seek alternative options of moving their offshore manufacturing base to their home country as the manufacturing costs in the offshore developing countries have substantially increased [46]. In recent years, there is a geographical shift of reshoring high value manufacturing activities back to the manufacturing firms’ home countries by moving towards value-added production rather than mass production [42]. Value-added production enables firms to focus on mass customization such that smaller batches of a wider variety with each product can be tailored to meet customer’s need. Value-added production has also resulted in falling production cost and thus lesser reliance on economies of scale [22, 26, 42]. Reshoring high value manufacturing activities back to the home countries can lead to the firm moving up the value chain as well as creating shorter and more responsive supply chains and improving communication with customers [17, 42]. In a study reported in the State of Profession Study of 2012 [46], 29% of the respondents claimed that their company will use 3D printing and AM, in particular for electrical equipment and appliance assembling company. Thus the literature review in this paper can contribute to the understanding of opportunities of AM in the wider industry sector. By gaining insights into potential opportunities of AM it is able to guide researchers to understand adoption of AM.

This research has its limitation that only three databases were used to conduct the literature search. More databases should be included in the study to ensure completeness of the search. It is proposed that further research can be conducted to investigate adoption of AM using Rogers’ model of diffusion of innovations [39]. Based on current result, it can be observed that the number of AM publications identified in this study exhibits an S curve of adopter distribution. There are five stages of innovation decision process in Rogers’ model: knowledge, persuasion, decision, implementation and confirmation. The adoption of innovation cannot occur without learning and knowing about the innovation, in this case the AM. An investigation on publication trends of potential and opportunity of AM in the industry is useful to help the wider industry community to understand and to gain insights of how AM is used and applied in the wider industry sector.

CONCLUSION

The AM industry has experienced tremendous growth in the last decade. Extensive research has been reported on engineering and technological challenges to improve AM and 3D technological advancement, however limited research reports on potential, opportunities and assessing impacts of the use of AM on society at large. This research attempted to fill this gap and the outcome of a preliminary systematic literature search is presented. Our results show that the number of publications in the AM research has increased exponentially since 2009. The papers have been identified into five themes that include applications, country, opportunity, economics and social. Our results show that there are an increasing number of papers that investigate economic and social benefits of AM. Further research is proposed to investigate adoption of AM using Rogers’ model of diffusion of innovations.

REFERENCES


ORGANIZATIONAL MOTIVATION: A SOCIO EMOTIONAL ENGAGEMENT PATHWAY FOR INTER-GENERATIONAL INTEGRATION
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ABSTRACT
A socio-emotional regulatory intersection between elder and younger individuals across their career-span in an organization offer insight into inter-generational motivational differences. When applied through an organizational hierarchy of needs framework a combined psychological pathway of organizational motivation (OM); and return on investment (ROI) can explain aspects of an individual’s organizational engagement. This quantitative study of 199 College of Organizational Psychologist members supports OM as an intermediary between ROI and three deliverance levels of organizational engagement (vision, mission and goals). This study shows socio-emotional regulation (in an organizational context) and OM (as a hierarchical engagement tool) as jointly influencing OM so that individuals can better bridge inter-generational gaps. Further, an OM approach used strategically when attracting employees with talent, when developing talent, and when integrating generations can add to the organization’s competitive position.

Keywords: Social identity, emotion, needs, behavior theory, return on investment (ROI)

INTRODUCTION
An individual member’s (IM’s) organizational behaviour is shaped by combinations of cognitive, social and biological forces, and various theories of behaviour now exist. Behavioural theory combinations, such as Social Identity Theory [41], Social Movement Framework [22], Socio-emotional Selectivity Theory [6], Dual Pathway models, and Hierarchy of Needs [28] explain an IM’s organizational behaviour in this study. Currently IMs within an organization typically show a broader working age range distribution than they did in previous decades. For example gen x, gen y, baby boomers, veterans, and the digital generation demonstrate an age diverse workforce.

Social Identity Theory (SIT) suggests the IMs of an organization possess a sense of social belonging to an organization [41]. This sense of belonging arises through a communal valuing of or partnering with an organization. Through SIT, an organizational social identity is measurable by either category and/or by inter- and intra-comparison across the organization’s active social networks. In -group out-group behavioural theory [41] approaches also apply to specific hierarchical levels within the organization [28].

Where IMs acquire a psychological connection to the organization and gain a sense of belongingness to the organization their social identity is enhanced [41] through unconscious comparisons and connectedness to others [41][14], both internal and externally with stakeholders.

This IM behavioural connectedness contributes towards organizational motivation (OM), and OM loops back to support the IMs belongingness perceptions of social identity connectedness within the organization [35]. When this organizational social identity connectedness is supported, OM presents connection pathways that enhance reputation, and actualises potential [28].

Similarly, belongingness perceptions of IMs are supported by levels of commitment and levels of opportunity [28] - with an IM’s positive feelings enhancing their perceptions of the organization’s reputation, while also priming the hierarchical perceptions that support their actualising potential. This behaviour is similar to opportunity and commitment conjointly supporting survival needs [28].

LITERATURE REVIEW
Organizational Social Identity
Motivational comparisons between elder and younger individuals show differing socio-emotional developments occur across the career-span. This also correlates with the perceived time left in an IM’s career [7].

Similarly, social movement research indicates identity OM and cognitive ROI jointly influence social identity [22]. Hence this study assumes the IM’s connectedness towards social identity with the organization and the IM’s positive OM jointly influences the IM’s organizational engagement. Similarly, social movement research indicates social identity is predicted by psychological dual pathways; based on collective identity OM, and based on cognitive ROI [22][32]. It is assumed therefore our feeling for our organization’s social identity; an individuals’ positive OM; predicts positive Organizational Engagement [32].

Social movement theory contributes to organizational engagement through steps towards, sustained participation and engagement [22]. To capture these aspects through organizational engagement this study analogises vision, goals, and mission.
Wright, Taylor, and Moghaddam [49] define organizational engagement as an IM’s engagement in social activities any time that he (or she) is acting as a representative of the organization, and where the action is directed at improving the conditions of the organization as a whole. Thus ‘vision’ is the IM’s intention to stay, ‘goals’ are the relationship bond between the individual and organization, and ‘mission’ is sustainable through the IM encouraging others to join, working on initiatives, serving on committees, and providing consultation.

Klandermans [22] links IMs development of motivation to engage to social norms and extrinsic rewards. Carstensen [6] argues organizational engagement behaves like chronological ageing development with emotion becoming salient as the individual ages. Here, elder individuals integrate positive social, psychological and cognitive recall, and so enhance their potential for positive social engagement.

Socio-emotional selectivity theory suggests elder individuals manipulate the organizations’ social environment to increase the emotional climate, and this seems more prevalent towards the end of the career-span and as retirement approaches [6].

This tendency of elder individuals to influence the emotional climate of the organization’s social environment also suggests the individual’s motivation is mediated by the organization’s affective identity. This influence may occur across three discrete individual OM levels termed ‘I (inter-individual perception), us (inter-organizational perception), and we (interpersonal uniformity perception)’ [5][32][37][37][35]. Here, the elder individual in the organization can display their relationship with other members at an individual identity level, and/or at a relational identity level and/or at a social identity level [5].

Organization Motivation

Lawler [24] argues an emotionally-affective process occurs across the continuous feedback loop between an IM’s affective social identity and their positive organizational engagement. From an organizational attachment perspective, social identity pulls the IM’s identity through a “me-to-us-to-we” connection, reflecting the need to belong with higher and lower order needs [28]. Within the IM, emotions generated across this feedback loop elicit significant social identity related feelings including: pleasure, displeasure, comfort, confidence, relation, enthusiasm, and sadness [24]. This interplay between the IM and their social interactions enables the IM to find meaning and understanding in their social relationships independent of their cost-benefit considerations (ROI), thus affectively motivating the IM [32].

Dual-pathway models exist for organizational collective action [22][33]. From social movement research, the costs and benefits (ROI) of IM and group participation, and collective social identity (OM) approaches, suggest both pathways operate independently [22]. Group members pursue external rewards and behave collectively, but each IM also follows their inner (inter-individual) obligatory pathway and enacts their (politiced) collective social identity [37].

Social identity theory [41] as the early approach to social identity later shifted towards self-categorisation theory [43]. Here self-interpretation processes mediated the transition from IM (behavioural) perceptions towards social (collective behavioural) perceptions and vice versa [19][20][32][43].

Based on Tajfel and Turner’s [41] Social Identity Theory (SIT) this dual pathway model suggests the motivation to follow vision, goals, and mission is driven by two different methods of information processing [38][33]. The first SIT pathway is a cognitive, logical, time consuming, rule-based, processing system, and it functions with cost-benefit calculations as return-on-investment (ROI). This cognitive path is a controlled, conscious activation, which may be subjected to cognitive biases and prejudices [32].

The second SIT pathway is a heuristic, emotional, time saving, spontaneous, shorter processing mode and it functions as OM as an autonomous, unconscious activation, which stimulates principle accuracy [32][Simon, 2003]. Simon argues each pathway can operate simultaneously in parallel and each is singly sufficient; or compensatory, for each other, yet both are unique predictors of social movement engagement [22].

Simon [32], Sturmer et al. [38], and Simon et al. [33] support a robust dual pathway model of organization engagement. However, these researchers do not find significant mediation or moderation effects between the pathways to organizational engagement (vision, goals, and mission). Nevertheless, literature does support an integrative psychological perspective of OM as a stronger predictor of organizational engagement when compared to the predictor ROI [46]. This research design is displayed through the framework model used in Figure 1.

Return on Investment

ROI is defined as a cognitive cost-benefit calculation which engages the individual socially in an organization. Clary et al. [10] found each individual who volunteered calculate the personal benefits of doing so. Serving as a transactional exchange, ROI depends on tangible ‘how can I benefit?’ extrinsic reward opportunities aimed at meeting basic needs [36]. Transactional exchange models emphasise each individual responds to the organization with expectations of gaining resources they desire, and with a view to maximise their motivation of personal gain and to minimise their personal cost [34][44][48].
Clary et al. [10] found volunteers behave similarly to paid employees and they expect their volunteering benefits to exceed their effort - regardless of explicit, intrinsic or extrinsic motivation. This gain-loss transactional argument explains: individual willingness to help others [10][11][39][42]; group cooperation [45]; work motivation payoffs [18][47]; and goal setting theory [13][23][25].

ROI is analogous of social systems founded in marketplace perceptions that organizational engagement abound in an exhaustive ocean of possible information, knowledge and relationships. Through market conditions the organizations’ social environment has become a commodity, thus “Life itself appears only as a Means of life” [17].

RESEARCH MODEL

![Diagram of the Socio Emotional Engagement Model]

The following hypotheses are proposed for examination:

**Hypothesis 1.** The Dual Pathway Hypothesis suggests OM mediates the relationship between ROI and Organization Engagement on three levels of criterion: (a) goals; (b) mission; and (c) vision.

**Hypothesis 2.** A socio-emotional development effect (supporting the control variables age, education, career status, and years of membership) moderates the relationship between ROI and three criterion levels Organizational Engagement: (a) vision; (b) goals, and (c) mission.

**Hypothesis 3.** OM moderates the relationships between ROI and three criterion levels of Organizational Engagement: (a) vision; (b) goals; and (c) mission.

RESEARCH METHODS AND DATA ANALYSIS

Participants and Procedures
The survey design is theoretically based, empirically supported and psychometrically sound, demonstrating a science practitioner model. The on-line survey is advertised through the College of Organizational Psychologists by email invitation; and respondent data is used in this study to report membership trends back to the College and its members. Ethics approval is attained for the use of the data in this study.

The data is collected from College of Organizational Psychologists members, through an on-line membership survey. Members offer their consent when initiating the survey and when accepting a chance to win an Apple iPod. 239 members responded to the survey and 40 incomplete responses were removed. Using exploratory factor analysis a model of interest is presented for examination.

Table 1 summarises correlations between the final data set’s (N=199) respondent demographics (age, gender, education, career status and years of membership) against vision, goal, mission OM, ROI.
Measures
The constructs in this study emerged through exploratory factor analysis. The demographic variables (age, gender, education, career status and years of membership) act as control variables. A British Psychological Society study found these each influence member retention, participation and commitment.

The criterion constructs are developed across three levels of Organizational Engagement - vision; goals; and mission. This study’s predictor constructs are - Return on Investment; and Organization Motivation, and these are developed to address the dual pathway hypothesis.

**Vision.** The vision subscale is measured with a one item scale adapted from the Tyler & Blader [44] Intention to Remain with the Organization scale (with coefficient alphas α=0.94). This item is adapted by including the membership organization name and scope. Responses are measured on a 3 point disagree, unsure or agree scale - using the question “In the next 12 months, I plan to remain a member of COP?”

**Goals.** The Goals subscale is measured with a five item scale adapted from the Mowday, Steers & Porter [31], Organizational Commitment Questionnaire (OCQ), and coefficient Alphas for this scale ranged from α=.82 to .93. Responses measuring the extent to which participants agree or disagree with statements about COP’s goals and objectives are measured on a 5 point Likert scale ranging from 1 (Strongly disagree) to 5 (Strongly agree). An example item is “COP’s goals and objectives are relevant and appropriate”.

**Mission.** The Mission subscale is measured with a five item scale adapted from Tyler & Blader [44] Cooperative behaviour subscale – with coefficient Alphas for this subscale ranged from α=.76 to .80. Responses on the extent to which members engage in cooperative behaviours are measured on a 5 point Likert scale ranging from 1 (Hardly ever) to 5 (Very often). An example item is “I have volunteered to work on projects, committees and/or initiatives for COP.”

**Organizational Motivation.** The Belongingness subscale is measured with a five item belonging subscale adapted from the Mael & Ashforth [27], Organizational Identification (OI) scale; and an Affective Commitment subscale (measured with seven items) adapted from the Allen & Meyer [1] Affective Commitment (AC) scale. Coefficient alphas for these scales are α=.74 OI and α=.85 AC. Responses are measured on a 7 point Likert scale ranging from 1 (Not very much) to 7 (Very much) belonging; and on a 5 point Likert scale ranging from 1 (strongly disagree to 5 (strongly disagree). These items are adapted from the original scale items to include College details – for example “How much do you feel strong ties with colleagues in COP?” and “I feel emotionally attached to COP”.

Opportunity sub-scale is measured with a five item subscale adapted from the Tyler & Blader [44] Relational and Control scale. Coefficient Alphas for the opportunity sub- scale ranged from α=.76 and .88. Responses are measured on a 5 point Likert scale ranging from 1(very dissatisfied) to 5(very satisfied). An example item is; “I feel my opinions are taken seriously by COP”.

Satisfaction subscale is measured with a ten item subscale adapted from the Clary et al. [10], Volunteer Function Inventory (VFI) career subscale and a five item VFI enhancement subscale. Coefficient Alphas for these scales are α=.89 career; and α=.84 enhancement. Responses of the extent to which participants agree or disagree with statements about the value of their COP’s membership are measured on a 5 point Likert scale ranging from 1 (Strongly disagree) to 5 (Strongly agree). Example items include; “COP membership enhances my reputation among employers”; and “Membership lends credibility to work as an I/O psychologist.”

**Table 1. Correlations, Reliability, Mean, Standard Deviation of Control, Predictor & Criterion Constructs**

<table>
<thead>
<tr>
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<th>1</th>
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<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
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<tbody>
<tr>
<td>Age (1)</td>
<td>.11</td>
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<tr>
<td>Education(2)</td>
<td></td>
<td>.74**</td>
<td></td>
<td>.62**</td>
<td></td>
<td>.02</td>
<td></td>
<td>.17</td>
<td>.33**</td>
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<tr>
<td>Career (3)</td>
<td></td>
<td></td>
<td>.01</td>
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<tr>
<td>Yrs Member (4)</td>
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<td></td>
<td>.58**</td>
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<tr>
<td>Vision (5)</td>
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<td></td>
<td></td>
<td>.03</td>
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<tr>
<td>Goals (6)</td>
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<td></td>
<td>.12</td>
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<tr>
<td>Mission (7)</td>
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<td>OM (8)</td>
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<td>.17</td>
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<td>ROI (9)</td>
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<td></td>
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<td>.25**</td>
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<tr>
<td>Mean</td>
<td>3.52</td>
<td>1.37</td>
<td>2.4</td>
<td>8.69</td>
<td>2.92</td>
<td>3.72</td>
<td>2.51</td>
<td>3.53</td>
<td>3.2</td>
</tr>
<tr>
<td>SD</td>
<td>1.18</td>
<td>0.65</td>
<td>0.92</td>
<td>7.51</td>
<td>0.27</td>
<td>0.74</td>
<td>0.95</td>
<td>0.93</td>
<td>0.74</td>
</tr>
</tbody>
</table>

(N=199) ** correlation significant at p < 0.01 level (2-tailed).
**Return on Investment.** The Return on Investment (ROI) subscale is measured with six items adapted from the Volunteer Functions Inventory [10]. Coefficient Alphas for this scale ranged from .84, suggesting good reliability. Participants are asked to rate the extent to which they agree or disagree that their membership provides good value for money on a 5 point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). An example item is; “There is a good return on investment for COP membership.”

**RESULTS**

**Assumption Testing**

SPSS for Windows 16.0 is used to analyse the survey response data. The data is assessed, cleansed and checked for anomalies including errors related to data entry, survey responses recoded, missing values, outliers and assumptions of normality. The data set contains responses from 239 participants. Frequency descriptives show 32 items held above 5% of missing values. A total of 40 respondent cases are deleted, hence (N=199).

Cases with less than 5% missing data are were replaced using SPSS missing value replacement procedures. Assumptions of normality, linearity and homoscedasticity show all 199 cases and all variables meeting assumptions.

A preliminary multiple regression analysis screens variables through residuals. No consequential violations of normality and homogeneity of variance are observed. None of the predictor constructs correlated above 0.7. Thus multicolinearity is not been a problem in this study. Descriptive analysis reveals the means score, standard deviation, skewness, kurtosis and standard error for each construct and are detailed in table 1.

**Analysis**

Exploratory Factor Analysis determines which items may be developed into scales and subscales for the current study. Forty nine items load under Principal axis factoring method with varimax rotation and an eight rotation matrix construct extraction emerges. These explain 66% of the variance.

Means, standard deviations, inter-correlations and reliability coefficients are presented in Table 1. A path analysis (controlling for age, education, career status and years of membership) is developed to determine the effect of Return on Investment (ROI) on Organizational Motivation and Organizational Engagement criterion constructs (Figure 2). The dual pathway hypothesis is tested using mediated hierarchical regression. To further test hypothesis for social development effects, the control variables (age, education, career status and years of membership) are moderated with ROI and OM using moderated regression analysis.

![Path Analysis - Standardised Beta Weights for Organizational Engagement](image)

**Mediation Models**

The Dual Pathway Hypothesis is tested under mediated hierarchical regression. Steps to establish relationships among the follow Baron and Kenny [3]. This study tests whether Organizational Motivation (OM) fully mediate the relationship between Return on Investment (ROI) and each level of criterion construct - vision, goals, and mission (controlling for age, education, career status and years of membership).

Testing for mediation involves three steps [3]. First, the predictor construct must predict the criterion construct when the mediator is not included. Second, the predictor construct must predict the mediator. Third, when the predictor and mediator variables are both included in the regression analysis, the mediator and not the predictor construct predicts the criterion construct. If the
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Prince, Hamilton & Tee

predictor construct no longer significantly predicts the criterion construct when the mediator is controlled then complete mediation has occurred.

Following Baron and Kenny [3], this study explores the mediated regression models for each level of criterion construct and summarises its findings in Table 2.

Table 2. Mediated Hierarchical Regression - OM Mediating ROI against Vision, Goals, Mission

<table>
<thead>
<tr>
<th>Criterion Variable</th>
<th>β</th>
<th>R² adj</th>
<th>R² change</th>
<th>FΔ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vision</td>
<td>0.10</td>
<td>0.14</td>
<td>0.01</td>
<td>0.27</td>
</tr>
<tr>
<td>Step 1 – ROI</td>
<td>0.32</td>
<td>0.08</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OM</td>
<td>0.40</td>
<td>0.14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Step 2 – ROI x OM</td>
<td>0.70</td>
<td>0.42</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Goals</td>
<td>0.13</td>
<td>0.40</td>
<td>0.01</td>
<td>0.07</td>
</tr>
<tr>
<td>Step 1 – ROI</td>
<td>0.50</td>
<td>0.30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OM</td>
<td>0.61</td>
<td>0.39</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Step 2 – ROI x OM</td>
<td>0.65</td>
<td>0.42</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mission</td>
<td>0.00</td>
<td>0.35</td>
<td>0.00</td>
<td>0.99</td>
</tr>
<tr>
<td>Step 1 – ROI</td>
<td>0.30</td>
<td>0.23</td>
<td></td>
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<tr>
<td>OM</td>
<td>0.47</td>
<td>0.36</td>
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<tr>
<td>Step 2 – ROI x OM</td>
<td>0.65</td>
<td>0.42</td>
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</table>

Moderation Regression Analysis
Moderation regression analyses are conducted to investigate whether a career social development hypothesis may be supported. Baron & Kenny [3] argue this is desirable if the moderator variable is uncorrelated with both the predictor and criterion constructs. The demographic variables (age, education, career status and years of membership) may therefore function as moderator variables and influence the relationships between the predictor constructs – ROI, and OM, and the criterion Organizational Engagement constructs - vision; goals; and mission.

Moderation first tests the predictor x moderator. An SPSS transformation multiplies ROI (mean) x age (mean). Regression of ROI, age, and ROI x age against vision checks if ROI x age shows age having a significantly negative moderation of the relationship between ROI and vision β=-.20, t(193)=-2.26, p<.05. Similar moderation regression analyses shows Career status as significantly negatively moderating the relationship between ROI and vision β=.280, t(193)=-3.16, p<.01, and Career status significantly moderating the relationship between OM and vision β=.424, t(193)=2.77, p<.01. Years of membership also significantly negatively moderates the relationship between ROI and vision β=-.24, t(193)=-2.43, p<.05, and OM significantly negatively moderates the relationship between ROI and vision β=-.365, t(193)=-5.69, p<.000. Lastly OM significantly moderates the relationship between ROI and mission (T1) β=.211, t(193)=3.26, p<.001.

DISCUSSION
This research seeks to examine the data for socio-emotional generational gaps, and looks for an emotional regulatory intersection [6]. It measures an Organizational Engagement dual pathway model, using the constructs of OM and ROI, and three criterion constructs - vision, goals, and mission. The influence and mediation effects of OM on the relationships between ROI and the criterion Organizational Engagement constructs - vision, goals, and mission is found to be significantly meaningful in terms of understanding an inter-generation socio-emotional regulatory intersection.

OM is found to serve as both a mediating variable and a moderating variable that helps identify the strongest pathway predictor of three levels of Organizational Engagement. The demographic variables serve as control variables and they moderate the constructs sequentially; supporting a career-span emotional development effect through identifying an emotional regulatory intersection [7].

Using a dual pathway model to determine three levels Organizational Engagement - vision, goals, and mission, this study contributes a unique understanding of OM and proposes a theory of inter-generational integration [22]. The results are unique and have never been previously found or supported. Therefore literature support remains limited. Interpretation and conclusions of these results draw upon the theoretical possibilities of supporting research and theories.

Mediated hierarchical regression results confirm OM is the stronger predictor of Organizational Engagement on the three levels of criterion constructs - vision, goals, and mission - thus influencing how we think about ROI.
IMPLICATIONS FOR RESEARCH

Theoretical Implications
Age; career status; and years of membership influence the relationship between ROI and vision, while career status moderates the relationship between OM and vision - indicating the Elder members held the vision of influencing the mission stronger than the Younger members who thought more about cost benefits ROI. These findings indicate ROI likely influences a Younger members decision to engage with the mission, whereas the Elder members tend to engage based on their past experience.

OM is more likely to influence Elder members’ decision to engage with the mission through the strength of their desire for the social identity [41]. These results are consistent with socio-emotional selectivity theory of an emotional regulatory intersection (the realisation of time left in their career theory). Therefore, understanding the levels of individuals’ identity and how the individual connects with experience can help transform the psychological through the social [32]. Future research may consider how transformational interventions might be tested on this OM model.

ROI and OM both predict three levels of Organization Engagement - vision, goals, and mission. The interplay between these three variables is analogous of the connection between human consciousness, feeling and action [16]. Ekman [15] explains the dual process as two minds: the emotional mind; and the rational mind. The emotional mind is a faster processor than the rational mind - actioning before thinking about what the individual is doing. An example of this may be the emotional reaction of anger causing road rage behaviour, before the rational mind establishes the danger in doing so.

The appraisal of the need to act is facilitated by a primary emotional response at an interval of thousandths of a second prior thought [15], and is also consistent with OM being a stronger predictor of Organizational Engagement than ROI. Ekman [15] explains that when the emotion is strong, the response is obvious, such as the previous anger example. When the emotional response is unconscious (due to the ‘association’ with a cognitive memory), the ‘association of the emotion’ symbolises the reality of the past in the present, not objective reality - thus enacting a new reality. In following this logic OM is analogous of the emotional mind mediating the relationship between ROI (the rational mind) and Organizational Engagement (the action), that we find support for objectivity.

The emotional mind establishes collective values, beliefs, norms and assumptions (culture) as subjectivity, dependent upon past unconscious recollection (memory). According to Socio-emotional Selectivity Theory, the moderation results support the socio-emotional selectivity theory that the interaction between emotion and cognition serves as an emotional regulator [9]. OM predicts Organizational Engagement developmentally across the career-span, through the increasing salience of emotional regulation [6]. Thus, OM functions as an unconscious emotional regulator and through positive emotional arousal typically based on an individuals’ social identity unconsciously finds understanding and meaning in the Organization through values, beliefs, norms and assumptions [22].

In discussing the demographic moderation effects that influence ROI and vision; and OM and vision, we note only age, career status and years of membership variables are influential. Socio-emotional selectivity theory supports emotional regulation as a career-span development effect and helps understand the implications of these moderation results. These moderation results support the existence of an inter-generational career development effect that acts across the career-span, and support that age, career status and years of membership do influence the OM and ROI constructs as predictors of Organizational Engagement. Therefore the results found in this study can be viewed as genuine socio-emotional career-span development effects [6].

Practical Implications
The OM construct has development implications that may be leveraged in organizations to motivate human potential. In terms of utilizing the OM construct as a motivation for emotional regulation and engagement, the career-span development perspective confirms the potential for manipulation and development [8][9].

Klandermans [22], Simon [33][32] and Sturmer et al. [37] support the robustness of the social movement dual pathway model used in this study and confirm its generalizability to other groups and across nations. This profession based College member study provides support for a career life-span and individual member development perspective around connection to the organization. It is therefore anticipated that these findings may support a theory of Inter-Generational Integration Development.

Current organizational challenges in the workplace include inter-generational differences and ageing workforce. With the largest generational group, the baby-boomers currently set to leave the workforce, organizations are challenged by the shortage of talent and leadership potential. As OM is an organizational construct like Maslow’s hierarchy of needs, it may be manipulated and developed in individuals to actualise human potential. As a strategy for attracting and developing talent to gain Organizational edge, OM has the potential to motivate, engage and develop employees and may be used as a leveraging tool for understanding individuals and developing tomorrow’s leaders.
CONCLUSION

In conclusion, the current research contributes to the limited literature in the field of career-span motivational differences. The motivational differences between Elder and Younger individuals over the career-span are correlated with Organizational Engagement. This proposed theory and model are supported by Socio-emotional Selectivity Theory, Social Identity Theory, Social Movement Framework, Dual Pathway models, and Hierarchy of Needs. The argument is presented that a socio-emotional regulatory intersection is responsible for the inter-generational motivational gap, and this is explored over three criterion levels of Organizational Engagement: vision, goals, and mission. The predictor constructs OM and ROI were used to explain dual pathways. Participants (N=199) from the College of Organizational Psychologists completed a survey and responses displayed strong reliability and validity. The statistical findings support the inter-generational regulatory intersection with OM serving as both mediator and moderator of the relationships ROI holds with three levels of Organizational Engagement: vision, goals, and mission.

This new research contributes to the relatively unexplored field of socio-emotional regulation in organizational context, and OM as a hierarchical engagement tool. Results suggested OM has manipulative properties – both individually and collectively, and can help bridge inter-generational motivational gaps. OM has practical implications when developing strategies to attract and develop talent, and to better integrate generations in the workforce. It also may offer some potential in the provision of organizational competitive edge.

As a construct OM may benefit from further manipulative testing into a leveraging tool targeting the understanding of individuals and developing tomorrows’ leaders. Beyond the scope of this study, more comprehensive longitudinal research may also provide a promising direction for OM when targeting developing human potential and when targeting increasing Organizational Engagement.

REFERENCES


The Fifteen International Conference on Electronic Business, Hong Kong, December 6-10, 2015
RELATIONSHIP BETWEEN AUDIENCE ENGAGEMENT ON SOCIAL MEDIA AND BROADCAST MEDIA RATINGS

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ABSTRACT

People often share their opinions or impressions about TV shows (e.g., dramas) with other viewers through social media such as personal blogs and Twitter. As such, broadcast media, especially TV, lead to audience engagement on social media. Moreover, the audience engagement, in turn, impacts broadcast media ratings. Social TV analyzes audience’s TV-related social media behaviors and tries to use the behaviors in marketing activities such as advertisement; however, this is purely based on the quantity of engagement in social media. In this study, we analyze the subjects of the audience engagement on social media about specific TV dramas through topic modeling, and examines the relationship between changes in the topics and viewer ratings of the TV dramas.

Keywords: Social media, broadcast media, topic modeling, topic trend, VAR.

INTRODUCTION

Social media is a hot research topic nowadays. The responses in social media helps prediction and estimation in various areas such as election [6] and marketing campaign [10]. Recently, the relationship between social media and other types of media is drawing attention. The purpose of this paper is analyzing the relationship between audience engagement on social media and broadcast media ratings. It looks somewhat complicated but the basic idea is very simple. People watches TV and talks about it on social media, so we can guess that the viewing TV shows will affect conversation about the TV shows on social media. Moreover, we can guess that the conversation will also affect viewing again, which means someone who participated in the conversation but did not watch the shows can decide to watch the shows. However, this idea is not a very new one. For example, Social TV is a study about television-related social behavior [2]. They tried to support communication and social interaction around TV with new applications [3]. Some studies about social TV suggested measures on social media activities tied to specific TV broadcasts. Bluefin [4] is an example of such social TV that focused on the intersection of TV and social media. The company tried to provide new insight into audience engagement and suggested two types of metrics to measure the audience response to television by using conversations in social media. One metric is measured the number of commenters for episodes of a drama in the response level. The other metric is about response share that is the percentage of the share of audience response in social media.

Social TV was the hottest area once, but an article of GIGAOM at 2014 showed that most of the social TV efforts failed [6]. It presented some evidences for the failure. Yahoo announced that it would shut down Intonow and i.TV also discontinued GetGlue. In addition, most of the social TV startups such as Matcha, Tunerfish and Screentribe failed to make TV social. However, we don’t think it means that the insight from social media is useless. They focused on providing social media services for TV. But, there were already Twitter and Facebook that are elephants in social media services. The insight from social media response is still very important. It is just time to move on and try something new [11].

We believe that one of those “something new” is a semantic analysis of social media conversations. Most of the metrics suggested by social TV are quantitative analysis which counts the number of certain keywords in social media conversations. However, we are interested in the topics discussed about TV in social media. Once we extract topics from social buzz with text mining tools such as topic modeling [13], we also can analyze the relationship between the semantics of social media topics and viewer ratings of a certain TV show. In other words, we can find how they affect each other.

Therefore, the fist research question of our study is what topics about TV dramas are discussed in social media. We can use topic modeling which is one of popular text mining techniques in this semantic analysis [8]. The second question is if the topics and viewer ratings have certain trends over time. Topic trend analysis will be used for this question by using the results of topic modeling. The last question is that there is a relationship between the topics and the viewer ratings. There could be various relationships between topics or between a topic and viewer ratings. The vector autoregression (VAR) which is an econometric model for the analysis of the linear interdependencies among multiple time series will be used for the question [12].

RESEARCH METHODOLOGY

Why Dramas Are Important?

There is a report about the economic ripple effect of “My Love from the Star” which is a very popular and successful Korean drama in Asia [5]. It estimated the overall sales including advertisement sales, oversea sales, related products and tourist as $478 million. Moreover, domestic production inducement effect was estimated as $910 million and value-added inducement effect was estimated as $374 million. It is a well-known story that Netflix used big data analysis in the design of the famous drama “House of Cards”. The article about the background and detailed story of which title is “Giving Viewers What They Want” [1] insists that big data analysis required for finding tastes and requirements of audience is very important in designing a drama, and it is a formal

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Selection of Social Media and Dramas

We chose five Korean dramas based on the rank of each drama category [7]. Table 1 shows a brief summary of the dramas. We collected data including viewer ratings about dramas from Naver.com (http://search.naver.com/search.naver?where=nexearch&query=%EB%B3%84%EA%B7%B8%EB%8C%80&sm=top_hty&fbm=1&ie=utf8) which is the representative portal in South Korea. Naver.com provides viewer ratings of each episode of dramas provided by Nielson Korea (http://www.agbnielsen.co.kr/). Viewer ratings, which is called Nielsen ratings (https://en.wikipedia.org/wiki/Nielsen_ratings), are the audience measurement systems to determine the audience size. It is required to give attention to the number of episodes. Some of dramas have a quite small number of episodes for statistical analysis. Moreover, those were not broadcasted every day of the week. It means that the time-series data are irregular. The two things became problems in our analysis.

Table 1. Summary of Selected Dramas

<table>
<thead>
<tr>
<th>Company</th>
<th>Title</th>
<th>Period</th>
<th>Number of episodes</th>
<th>Broadcasting days (Category)</th>
<th>Rank</th>
<th>Viewer Rating (Avg.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>KBS</td>
<td>Wang Family</td>
<td>2013.08.31 ~2014.02.16</td>
<td>50</td>
<td>Weekend</td>
<td>1</td>
<td>33%</td>
</tr>
<tr>
<td>MBC</td>
<td>Empress Qi</td>
<td>2013.10.28 ~2014.04.29</td>
<td>51</td>
<td>Mon, Tues</td>
<td>1</td>
<td>21.9%</td>
</tr>
<tr>
<td>SBS</td>
<td>Dr. Stranger</td>
<td>2014.05.05 ~2014.07.08</td>
<td>20</td>
<td>Mon, Tues</td>
<td>2</td>
<td>11.7%</td>
</tr>
<tr>
<td>SBS</td>
<td>My Love from the Star</td>
<td>2013.12.18 ~2014.02.27</td>
<td>21</td>
<td>Wed, Thurs</td>
<td>1</td>
<td>24%</td>
</tr>
<tr>
<td>tvN</td>
<td>Misaeng</td>
<td>2014.10.17 ~2014.12.20</td>
<td>20</td>
<td>Fri, Sat</td>
<td>1</td>
<td>5.4%</td>
</tr>
</tbody>
</table>

The next step was choosing a social media service. There is a report about the social media usage in South Korea [9]. Facebook was the number one social media service with 77.4% of usage share, but it is very difficult to crawl the contents from Facebook because it just provides search API on the connections between users instead of general search on every walls. Therefore, we chose the second social media type, Blogs of which market share is 30% and it is easy to search with keywords. Moreover, the contents are long enough for text mining. Among the various Blog services in Korea, we chose NAVER Blog because its market share is 71.2% in the Blog market area.

Analysis Framework

Our analysis framework consists of four steps which are Blogs crawling, topic modeling, topic trend analysis and VAR analysis. The first step is crawling documents from the NAVER blogs. This step consists of getting HTML documents from the blogs and parsing them. After that, we extracted the original form of nouns through morphological analysis. The second step is topic modeling with the crawled documents. We used Mallet which is a well-known topic modeling tool. In this step, we analyzed the topics and named those. The third step is generating topic trends from the results of topic modeling. For each topic, we calculated a trend over the broadcasting days and matched with corresponding viewer ratings. The last step is time-series analysis with VAR model for finding the relationship between the topics and the viewer ratings.

**TOPIC TREND ANALYSIS OF SOCIAL MEDIA ON DRAMAS**

Crawling Documents from Blogs

The broadcasting days of the most dramas are irregular as mentioned before while there are social media conversations every days of the week. Therefore, we crawled Blog documents written at the day after broadcasting for future use in addition to the days of broadcasting. For example, we crawl the documents of Monday, Tuesday, and Wednesday if the broadcasting days are Monday and Tuesday. It is interesting that the number of documents is not always proportional to viewer ratings. For example, “Wang Family” has the highest viewer rating but the lowest number of documents. On the other hand, “Misaeng” which means incomplete life has the lowest viewer rating while it has quite many documents compared to other dramas.
Topic Modeling Results

A topic model is a generative model for documents [13]. One of assumptions of topic modeling is that documents are mixture of topics and a topic is a probability distribution over words. That is, different documents can be generated by picking a set of topics with weights given to each topic. Therefore, we can infer topics that were most likely responsible for producing a set of documents. One of issues in our research was determining the number of topics. It is hard to interpret the results in addition to document name, topics and weights for each document. Therefore, we chose 5 out of 10 topics generated from the results based on the overall weight of each topic. That is, we removed the topics with lower weight. After that, we named topics but this process is somewhat subjective. Table 3 shows a topic modeling result of “My Love from the Star”. It is interesting that we could identify clear topics that show different subjects as shown in the table. The topics “Food” and “Fashion” are very clear. Songee, Dominjun, Semi and Jaekyong are main characters of the drama, and the remaining words of “Story/Roles” are about the story of the drama. For “Drama – General talk”, “The heirs” and “The thieves” are titles of other drama and movie, and other words are general terms about drama. The words of “Daily Life” are not about the drama. We could extract seven common types of topics from all target dramas.

<table>
<thead>
<tr>
<th>Topic Title</th>
<th>Weight</th>
<th>Words of Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food</td>
<td>0.1318</td>
<td>Food, price, cheese, strawberry, pizza, ice coffee, sweet potato, cafe …</td>
</tr>
<tr>
<td>Fashion</td>
<td>0.1251</td>
<td>Overcoat, price, style, sunglasses, dress, jacket, fashion, skirt, shirt, …</td>
</tr>
<tr>
<td>Story/Roles</td>
<td>0.1453</td>
<td>Songee, Dominjun, Semi, Jaekyong, alien, star, epilogue, kiss, supernatural power, …</td>
</tr>
<tr>
<td>Drama – General talk</td>
<td>0.1817</td>
<td>Drama, viewer rating, casting, review, actress, The heirs, The thieves, acting ability …</td>
</tr>
<tr>
<td>Daily Life</td>
<td>0.2056</td>
<td>You, today, mobile, thought, photo, love, We, human, sister, time, one day, friend, now…</td>
</tr>
</tbody>
</table>

Topic Trends of Social Media and Viewer Ratings

Topic trends provide changing trends of topics over time [9]. First, we calculated the average of weights of each topic over the documents of the same day. After that, we multiplied the average with the number of documents to reflect the effect of the intensity of social buzz. As the results of topic trend analysis, we could get the popularities of each topic for each broadcasting day for every drama. Table 4 shows the time-series vectors that consists of broadcasting date, viewer ratings and popularities of topics. In the table, each topic including viewer ratings has time series because those varies over broadcasting days.

Table 2. Results of Crawling from Blogs

<table>
<thead>
<tr>
<th>Title</th>
<th># of Broadcasting</th>
<th># of Viewer</th>
<th># of Documents</th>
<th>Avg. # of Documents per Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wang Family</td>
<td>50</td>
<td>75</td>
<td>4,818</td>
<td>64.2</td>
</tr>
<tr>
<td>Empress Qi</td>
<td>51</td>
<td>77</td>
<td>10,130</td>
<td>131.6</td>
</tr>
<tr>
<td>Dr. Stranger</td>
<td>20</td>
<td>30</td>
<td>5,249</td>
<td>175.0</td>
</tr>
<tr>
<td>My Love from the Star</td>
<td>21</td>
<td>32</td>
<td>43,913</td>
<td>1372.3</td>
</tr>
<tr>
<td>Misaeng</td>
<td>20</td>
<td>30</td>
<td>15,787</td>
<td>526.2</td>
</tr>
</tbody>
</table>

Table 3. A Topic Modeling Result of “My Love from the Star”
Table 4. Trend of Topics and Viewer Ratings of “My Love from the Star”

<table>
<thead>
<tr>
<th>Broadcasting Date</th>
<th>Viewer Ratings</th>
<th>Popularity of Each Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Daily Life</td>
<td>Story/Roles</td>
</tr>
<tr>
<td>2013-12-18</td>
<td>15.6</td>
<td>73.5</td>
</tr>
<tr>
<td>2013-12-19</td>
<td>18.3</td>
<td>176.0</td>
</tr>
<tr>
<td>2013-12-25</td>
<td>19.4</td>
<td>78.4</td>
</tr>
<tr>
<td>2013-12-26</td>
<td>20.1</td>
<td>168.1</td>
</tr>
<tr>
<td>2014-01-01</td>
<td>22.3</td>
<td>92.5</td>
</tr>
<tr>
<td>2014-01-02</td>
<td>24.6</td>
<td>208.9</td>
</tr>
<tr>
<td>2014-01-08</td>
<td>24.1</td>
<td>220.6</td>
</tr>
<tr>
<td>2014-01-09</td>
<td>24.4</td>
<td>351.8</td>
</tr>
<tr>
<td>2014-01-15</td>
<td>23.1</td>
<td>298.5</td>
</tr>
<tr>
<td>2014-01-16</td>
<td>24.4</td>
<td>415.9</td>
</tr>
<tr>
<td>2014-01-22</td>
<td>24.5</td>
<td>406.7</td>
</tr>
<tr>
<td>2014-01-23</td>
<td>26.4</td>
<td>646.5</td>
</tr>
<tr>
<td>2014-01-29</td>
<td>24.8</td>
<td>332.2</td>
</tr>
<tr>
<td>2014-02-05</td>
<td>25.7</td>
<td>396.5</td>
</tr>
<tr>
<td>2014-02-06</td>
<td>25.9</td>
<td>533.9</td>
</tr>
<tr>
<td>2014-02-12</td>
<td>25.7</td>
<td>480.1</td>
</tr>
<tr>
<td>2014-02-13</td>
<td>27</td>
<td>534.5</td>
</tr>
<tr>
<td>2014-02-19</td>
<td>27.4</td>
<td>449.9</td>
</tr>
<tr>
<td>2014-02-20</td>
<td>26.7</td>
<td>551.0</td>
</tr>
<tr>
<td>2014-02-26</td>
<td>26</td>
<td>436.2</td>
</tr>
<tr>
<td>2014-02-27</td>
<td>28.1</td>
<td>825.4</td>
</tr>
</tbody>
</table>

Figure 2 shows the topic trends and the change of viewer ratings of “My Love from the Star”. There are three outstanding peaks of topic weights in the graph because of suddenly increased number of documents of the day. Except for the peaks, the relationship between topics and viewer ratings is easily detected in the graph. It will be interesting if we look through topics of the peaks in detail to find out causes for our future research.
VAR ANALYSIS FOR TOPIC TRENDS AND VIEWER RATINGS

Issues of Using VAR
We used unstructured model for our basic structure in VAR model because of the irregular days of broadcasting. Adjusted topic weights and the viewer rating of each day were assigned for endogenous variables. Topic weight is a relative value among topics of a document. Therefore, we multiplied the average topic weights with the number of documents to reflect the quantity of social media buzz as we mentioned before. As the result, we could get better results in Granger causality tests and relationships among topics. The most important issue in our analysis is the insufficient observations. Therefore, we limited the number of topics of each drama for three or five. Moreover, we estimated viewer ratings of the day after broadcasting. For example, we calculated the viewer rating of Wednesday which was not a broadcasting day with the average of viewer ratings of Tuesday and the next Monday.

VAR Analysis Results
Table t shows the VAR results of “My Love from the Star”. The topic “Story/ Roles” negatively affects other topics and viewer rating of the next period. The more topics about roles and stories (that are specific to drama) are, the less other topics are in most cases. The trend scores are relative, so it means that social media buzz tends to focus on specific contents of a drama as time goes by. On the other hand, viewer rating positively affects every topics and viewer rating itself as we expected.

There are some common observations on all dramas. First, in most cases, viewer rating positively affects topics. Second, Topics hardly affect viewer rating. We guess it is because Blog is a kind of diary, so it is hard to influence other people. Third, the topic “Story/ Roles” negatively affects other topics and viewer ratings in most cases. Fourth, the topics such as background and philosophy seem to stimulate other topics.
CONCLUSION
We developed a method to analyze the relationship between social media activities and TV viewer ratings. In detail, we conducted topic model analysis on 5 popular Korean famous dramas, topic trend analysis on the dramas and VAR analysis on topics and viewer ratings. We found some meaningful relationships between the topics discussed in social media and the viewer ratings. For example, viewer rating positively affects topics and topics hardly affect viewer rating. Moreover, the topic “Story/Roles” tends to negatively affect other topics and viewer ratings in most cases.

There is a lot of future research topics. First, we need to control irregular broadcasting days even though we used some techniques in the study. This will be the most important issue of our next research. Second, we need to increase the degrees of freedom in order to analyze more topics. Third, we need to add control variables such as viewer ratings of TV News to enhance the model. Last, we need more in-depth analysis on topics to get better interpretation of topics.

ACKNOWLEDGEMENT
This work was supported by the overseas research program of the SBS Foundations.

REFERENCES

Table 5. VAR Results of “My Love from the Star”

<table>
<thead>
<tr>
<th>STORY_ROLES (t-1)</th>
<th>DAILY_LIFE (t-1)</th>
<th>FOOD (t-1)</th>
<th>VIEWER_RATING (t-1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-0.811</td>
<td>1.456</td>
<td>-0.640</td>
<td>17.476</td>
</tr>
<tr>
<td>[-2.404] *</td>
<td>[1.774]</td>
<td>[-0.760]</td>
<td>[2.103] *</td>
</tr>
<tr>
<td>[-2.855] *</td>
<td>[1.946]</td>
<td>[-0.860]</td>
<td>[3.095] *</td>
</tr>
<tr>
<td>[-2.990] *</td>
<td>[1.754]</td>
<td>[-0.563]</td>
<td>[3.312] *</td>
</tr>
<tr>
<td>[-3.175] *</td>
<td>[0.225]</td>
<td>[0.674]</td>
<td>[13.295] *</td>
</tr>
</tbody>
</table>

R-squared: 0.470, 0.580, 0.619, 0.939
ABSTRACT
With the constant development and evolution of “Internet+” strategic thinking, the electronic commerce enterprises have obtained the unprecedented growth, but also faced with great survival pressure and challenges. This research is based on the review and combing the historical development of capability maturity and in the light of the characteristics of e-commerce enterprises building a capability maturity model which contains five levels: the initial level, the repeatable level, the standard level, the managed level and the optimal level and five dimensions: strategy, organization, process, personnel and technical support. The capability maturity initial model of e-commerce enterprises establishes basic demand are obtained earnings, controlling risk and optimizing resources and with different stages of target the capabilities the electronic commerce enterprises should owned, at last this model generalizes a clear direction and standard for the e-commerce enterprises management.

Keywords: Internet+, e-commerce, capability maturity model, initial model.

INTRODUCTION
The goal of putting forward “Internet +”Strategy thought is based on the industry and the enterprises, with the help of the internet concept and technology, better integrating resources, reducing waste and improving efficiency. This thought applies to immediately need to be set up an internet platform or relying on the public platform of traditional enterprises, be more suitable for e-commerce enterprises. After years of exploration and practice, e-commerce enterprises have transitted from fuzzy definition, simple internal framework, basic business, strategic positioning of chaos, chaotic management, low personnel quality, lack of innovation and so on to the clear definition, reasonable internal architecture, business diversification, long-term strategic positioning, orderly management, personnel professional and owning sustainable innovation capability. However, behind a series of brilliant data, we can still find following pressure and crisis. Large number of e-commerce enterprises live in China, however, only a small own international competitive advantage, most of the electronic commerce enterprises although are supported by e-commerce systems to make online purchasing and online trading, they face of embarrassment of backward technology level, trading co., LTD., low market share and income and high cost, so this part of e-commerce enterprises need to think about how to develop to improve the competition capability and to continue to keep competition capability and many other problems. This study will focus on China's e-commerce enterprises survival present situation and adopt literature analysis and exploratory case study method, study from the perspective of enterprises core competence and build up the electronic commerce enterprises initial capability maturity model, in order to guide the development direction and planning of e-commerce enterprises.

ELECTRONIC COMMERCE ENTERPRISES CAPABILITY CONNOTATION
E-Commerce Enterprise
At present, there is no consensus of definition of the e-commerce enterprise concept. This study argues that e-commerce enterprise refers to an enterprise which completes key or the whole business process of enterprise through the electronic commerce activity [43]. Internet e-commerce activities here include trading and business activities through the internet, electronic trading and services through the value added network and transactions and services by connecting computer networks of enterprises or organizations [21], whose goal is to provide trade information and trade platform for public service and improve the efficiency of trading between the main of exchange. Electronic commerce enterprise is an important part in the global supply chain network, which deals product (service) to the traditional business with information process and reforms traditional process with the help of information technology and gets rid of time and space constraints for the traditional enterprises trading and service.

Core Competence of E-Commerce Enterprises
Enterprise competence refers to the capabilities to adapt to, coordinate and manage the enterprise internal and external environment and successfully be engaged in business activities. Enterprise competence includes many aspects, such as technical capability, innovation capability, management capability, marketing capability, etc. Some capabilities own high value because of making the enterprises keep sustained competitiveness and play an important role to enterprise's survival and development, and many kinds of capabilities play a role of comprehensive to form enterprises' unique characteristic called enterprises core competence. The core competence of enterprises is also called the core competitiveness, first put forward by C.K. Prahalad and Gary Hamel in 1990. Compared with traditional enterprises, e-commerce enterprises with the advantages of faster growth, stronger innovation capability and bigger resources and market share, so drawing lessons from the traditional enterprise's core competence to summarize e-commerce enterprise's core competence is limited [53]. Combined with the
definition of e-commerce enterprises in this study as well as many scholars research results of enterprise core competence, this study will conclude eight capabilities to be elements of e-commerce enterprise core competence such as knowledge capability, enterprise culture form (soft resources both to the enterprise core competence) [55], innovation capability, marketing capability, management capability, safety capability, service capability and dynamic capability [50], [23], [37], [54].

Knowledge. Knowledge is one of the most important strategy resources for e-commerce enterprises. Knowledge management includes acquisition, absorption, transformation, integration and application, the transformation and integration of knowledge are the core of knowledge management, and also the key factors to e-commerce enterprises’ innovation capability [52]. Qiao, Zhang and Man (2010) [42] consider by means of improving innovation capacity of enterprises and the efficiency of knowledge innovation and enhance the conversion rate of innovation in the enterprise knowledge management process will help to diversify product innovation and multi-functional innovation. Knowledge is an important support for enterprises be full of vigor, which can effectively enhance their core competences, the role of knowledge innovation on promoting core competence is immeasurable [15]. At the atmosphere of "Internet +", knowledge is the e-commerce enterprises’ key factor to achieve technology innovation, updating system, improving management, breaking through marketing and service innovation. It is also a revolutionary and ultimate power for organization revolution and management idea innovation of e-commerce enterprises.

Enterprise culture. Enterprise culture is an important spiritual support of core competence of enterprises, which determines the direction and pattern of enterprise development and also determines the choice and the degree of acceptance of different types and forms of knowledge. Enterprise culture owns static suffusion which is important for the development of the enterprise cohesion function, oriental function, incentive function and optimization function. The results of the survey by IBM consulting company for the global 500 enterprises showed that the fundamental reason for the success of the global 500 enterprises is their excellent enterprise culture, which is rooted in technology, products and management. Therefore, we can consider enterprise culture is core competence that cannot copy.

Innovation capability. Innovation is the enterprise impetus of progress and the core of economic competition. Continuous innovation is the most important source of sustainable competitive advantage. E-commerce enterprises must have the capability to continuous innovation, who want to stand out in the fierce market competition. And this continuous innovation needs internal joint efforts of enterprises from top to bottom. Zhong, Wu and Mei (2011) [58] who used the maximum likelihood estimation method considered that: (1) The top and mid-level managers should work hard and use the new management ideas and methods to keep thriving vigor and vitality of e-commerce enterprises, according to the development strategy of the e-commerce enterprises, who should combine the product properties with their own advantages and aim at the demand of the market to make clear market location, develop differentiated products and try best to satisfy customer purchase experience and after-sale service to promote customer satisfaction; (2) The enterprises should integrate resources in existing and complete supporting facility to maximize efficiency of core competitiveness specifically by means of using all kinds of internal and external resources to reduce cost, promote quality, increase efficiency, improve service, use competitiveness pricing and the other methods to achieve; (3) The enterprises should pay attention to protect the ecological environment of electronic commerce and urge other interdependency enterprises to make the corresponding development, so as to gain more customers and revenue.

Management capability. Management is the key to ensure the enterprises with orderly development, involving in personnel management, organization and coordination and many others aspects. Personnel management is an important part of the e-commerce enterprises management which promotes the core competitiveness of enterprises through the evaluation of employee qualification, the influence of employee behavior, improvement of employee knowledge and skill improvement. Organization and coordination covers the comprehensive capability of enterprise organization structure, organization motivation, cultural construction, coordinating mechanism and other aspects through the management process of institutionalization and rationalization to promote the transformation and upgrading of the core competence. Most of the e-commerce enterprises pay more attention to “electronic” which means improve and upgrade the IT technology, while ignoring the commerce achieved business transaction by means of management and thus lead to although enterprises have a competitive advantage technology, cannot support the enterprises to keep sustainable competitive capability.

Marketing capability. E-commerce enterprises provide consumers with products and services to meet their individual needs by improving the marketing strategy of the enterprises, the innovation of marketing technology and the construction of more advanced marketing network and expand market coverage and market share, form the barriers to prevent newcomers from entering the market in order to get higher profit for the enterprises to lay a solid foundation in quite a long time.

Security capability. E-commerce enterprises need to assess risk of the internal and external environment and make risk control measures. Currently most research on e-commerce security concentrates on credit risk or transaction risk, which focuses on network security risks such as data integrity and confidentiality, access control technology, security protocols, system security risk, legal security and so on, which is from the perspective of enterprises core competence and aims directly at e-commerce enterprise security capability is rare.

Service capability. As the electronic commerce enterprises' competition become more intense and enterprises network technology level and product differentiation degree becomes narrow, service competition among the enterprises is prominent.

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Personalized products and services become important contents of enterprises core competence, which is the most main method to improve customer satisfaction and to attract new customers and the most main method to promote the image of the enterprises. With the product and service contents constantly enrich and perfect, the service capability is increasingly important for the long-term development of the e-commerce enterprises.

Dynamic capability. Dynamic capability is about enterprise integration, building and reconstruction of internal and external competence to respond to environmental changes [48]. Dynamic capability is defined as organizational processes which enterprises use resources to adapt to change and even create market [13]. Dynamic capability can improve competitive advantage of e-commerce enterprises in dynamic environment by updating, creating, integrating, and reconstructing the function such as customer management capacity, management skills and technical capability [54], [39], [47]. With dynamic environment changing rapidly, the dynamic capability enjoyed by e-commerce enterprises is the key source of enterprises to acquire sustainable competitive advantages.

Development of Capability Maturity
"Mature" refers to the management capability to reach a certain state of specified requirements, the state can ensure the organizational goals realize well. Maturity is a specific quantification for the developing degree of things, is an capability to measure and assess to achieve the expected goals of an organization [51], which can be assessed by the enterprise itself or a third party and then propose effective and continuous improvement for enterprises [38]. Maturity is considered to be a kind of prospective, typical, reasonable and expected evolution [5]. Maturity thought came from the famous quality maturity grid theory put forward by quality management master called [10]. The earliest capability maturity model (CMM) was put forward by the Carnegie Mellon software engineering institute (SEI) in 1987, which was mainly used to improve and evaluate for the process of software development and the capability of software development. CMM considered promoting capability was a gradual process. It divided the development of capability maturity into five levels, initial level, repeatable level, defined level, managed level and optimizing level and 18 key process areas which gave a framework from the chaos of individual process to the maturity of standardization process (Software Engineering Institute, 2002). Capability maturity was a life cycle model, which constituted by definition, model design, application, test, adjustment and improvement [15]. Since 2000, the concept of capability maturity has been widely used in research field and application at home and abroad, such as the IT capability maturity, project management capability maturity, quality management capability maturity, knowledge management capability maturity, supply chain management maturity and so on.

Klimko (2001) [24] considered that a maturity model described the progressing process of an entity with the development of time, the entity can be a person or an organizational function. In fact, a maturity model has the following characteristics: an entity is from immaturity to maturity, whose development of process can be divided into a limited number of maturity levels; each maturity level has special requirements; maturity levels are ordered from the initial level to the highest level that continues to increase; the maturity level of an entity needs to step by step, each level cannot be crossed. Based on the previous research of software capability maturity model, business process management capability maturity model, supply chain capability maturity model and business intelligence capability maturity model, this study comes to the conclusion that the capability maturity model usually has the following properties: (1) the external structure of capability maturity is usually divided into five level, such as software capability maturity model (CMM) contains the initial level, repeatable level, defined level, managed level, optimizing level. Project management capability maturity model contains the initial level, structured level, managed level, institutional level. Project management capability maturity model (PMCC) contains the initial level, repeatable level, defined level, managed level, institutional level. Project management capability maturity model (PMMM) contains the initial level, repeatable level, defined level, managed level, optimizing level and 18 key process areas which gave a framework from the chaos of individual process to the maturity of standardization process (Software Engineering Institute, 2002). Capability maturity was a life cycle model, which constituted by definition, model design, application, test, adjustment and improvement [15]. Since 2000, the concept of capability maturity has been widely used in research field and application at home and abroad, such as the IT capability maturity, project management capability maturity, quality management capability maturity, knowledge management capability maturity, supply chain management maturity and so on.

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With the deepening of theoretical research on capability maturity and continuous development and expansion of capability maturity model, the research method of capability maturity model has shifted from qualitative to quantitative gradually. Development of e-commerce enterprises is a process of continuous improvement, perfect and innovation, which is in accordance with the connotation of the theory of capability maturity. Therefore it is feasible to construct and assess e-commerce enterprise model using the capability maturity theory.

THE E-COMMERCE ENTERPRISES CAPABILITY MATURETY INITIAL MODEL CONSTRUCTION
The Construction Methods of E-Commerce Enterprise Capability Maturity Initial Model
When constructs an e-commerce enterprise capability maturity initial model, this study references Lahrmann et al. (2011) [25] summarized the establishment of the general method of capability maturity model, which was divided into five steps: (1) Identify needs or new opportunities. When constructs a capability maturity model, we should find a new way to solve problems or the more effective way in the design process, which can be able to bring innovation or efficiency to the enterprise or organization to meet the needs and then be more conductive to the benign development of the enterprises. (2) Definition
scope. Selecting an appropriate range as an object to research and develop a capability maturity model with pertinence and practicability. (3) Design model. There are two design solutions. The first way adopts the design method from top to down that after selecting a design object, adopting the qualitative method through consulting literature and field research to obtain the main indicators and secondary indicators, according to the process to complete model design from top to bottom. Research of the capability maturity model construction for e-commerce enterprises mainly adopts this method. The other way mainly adopts the design method from down to top which typically extracts relevant indicators by means of quantitative, then summarizes these indicators and finally concludes the object model to be studied. (4) Evaluation design. Evaluating the efficiency, reliability, validity and suitability of the designed model through measurement software. (5) Improvement process reflection. Evaluation can reflect the shortage of the capability maturity model constructed then irrational structure should be adjusted or abandoned and reasonable structure should be left. See Table 1.

This research mainly adopts literature study of information extraction and expert interview. The initial model construction steps are as follows. First, for domestic database in CNKI data platform we search articles whose keywords contain “e-commerce enterprise” and “capability maturity” or “core competence” or “dynamic capability” or “capability assessment” or “capability model” or “evaluation model” or “division of level” or “dimension division” or “key process” or “key factor” or “influence factor”, set the time from 2005 to 2015 and finally find more than 900 articles (See Table 2). Then we aim at the foreign database in ACM, EBSCO, ProQuest, ScienceDirect and Web of Science to use the keywords of “e-commerce enterprise” and “maturity model” or “level of assessment” or “dimension analysis” or “key success factor” or “evaluation model”, set the time from 20050101to20150922 and eventually find more than 1900 articles (See Table 3). Finally, according to the quote frequency, subject classification and relevance to sort and eliminate these articles we get 131 articles to meet the requirements. According to research demand and integrity, we eventually filter out 77 articles with the most authoritative and the latest.

Table 1. The construction methods of capability maturity model

<table>
<thead>
<tr>
<th>Construction steps</th>
<th>Construction methods</th>
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<tbody>
<tr>
<td>1 .Identify needs or new opportunities</td>
<td>Innovative approaches</td>
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<td></td>
<td>Focus groups</td>
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<tr>
<td></td>
<td>Case study</td>
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<tr>
<td></td>
<td>Literature references</td>
</tr>
<tr>
<td></td>
<td>Field surveys</td>
</tr>
<tr>
<td>2 .Define scope</td>
<td>Provide information and data</td>
</tr>
<tr>
<td></td>
<td>Develop programmes</td>
</tr>
<tr>
<td>3 .Design model</td>
<td>Designed from top to bottom</td>
</tr>
<tr>
<td></td>
<td>Delphi</td>
</tr>
<tr>
<td></td>
<td>Case study</td>
</tr>
<tr>
<td></td>
<td>Literature references</td>
</tr>
<tr>
<td>4 .Evaluate design</td>
<td>Functional testing</td>
</tr>
<tr>
<td></td>
<td>Structural testing</td>
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<tr>
<td></td>
<td>Survey</td>
</tr>
<tr>
<td></td>
<td>Focus groups</td>
</tr>
<tr>
<td></td>
<td>Interview</td>
</tr>
<tr>
<td>5 .Reflect improvement process</td>
<td>Empirical study</td>
</tr>
<tr>
<td></td>
<td>Interview</td>
</tr>
</tbody>
</table>

Source: collating of data by authors.

Through studying and analyzing the 77 articles, this research determines preliminarily the dimensions and levels of the capability maturity model of e-commerce enterprises and concludes the key process areas of each dimension. On this basis, through three rounds of deepness interviews, we amends and confirms the concept model framework of e-commerce enterprise capability maturity finally. For the first round, we choose interview objects from the e-commerce major in colleges and universities included 3 Ph.D and 5 masters altogether 2 hours, which mainly concludes and extracts the dimensions sorted out by literature analysis. For the second round, we choose interview objects for 20 people of e-commerce enterprises’ executives and technical staff, who come from Shenzhen, Guangzhou and Foshan. All the interviews carries out in 10 times and each time lasts 30 minutes to 2 hours, which mainly concludes and extracts the key process areas according to the dimensions contained in the first round and then determines the level boundaries. For the third round, we choose interview objects for 3 experts in the field of e-commerce respectively to obtain expert advice for the first two rounds of the extracted dimensions, key process areas and key process indicators. After the third round of interviews, we ultimately determine the initial model of this study.
The Initial Model of E-Commerce Enterprises Capability Maturity Construction

This study preliminary constructs the initial model of e-commerce enterprises capability maturity with five levels and five dimensions by using value of e-commerce model [4], [59]. Cisco net ready model and capability maturity model for reference through the literature research and expert interviews. This model divides the capability maturity initial model of e-commerce enterprises into five levels include initial level, repeatable level, standardized level, managed level and optimized level and defines the evaluation standards at all levels of management capabilities of e-commerce enterprises from the five dimensions include strategy, organization, process, personnel and technical support.

The capability maturity dimensions and key process areas of e-commerce enterprises

Dimensions are capabilities we extracted from the enterprises core competence inclusion and intersection, which own stronger applicability and universal, higher general and degree of differentiation. The capabilities represents by each dimension contains a number of key factors or key process indicators.

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Firstly, the strategy dimension of e-commerce enterprises. Strategy affects all aspects of the e-commerce enterprise decision, which includes drawing up management strategies, management structure, system processes, technology research and development and personnel training. It decides the enterprises how to successfully carrying out e-commerce in daily production activities. Strategy is planning for an enterprise target, integrity and long-term issue. Its essence is to obtain the enterprise’s unique competitive advantages through affecting the rational allocation of the enterprise resources. It shows the cognition and attitude of the top managers to development planning of an enterprise. Thereby it affects the internal implementation of each work as well as the internal resources allocation. Therefore, the strategy capability has a significion impact for internal resources allocation and implementation of development planning of e-commerce enterprises.

Key process areas of strategy capability. To disassemble the strategy dimension, strategy capability includes strategic thinking capability, strategic resource management capability and the self-adaptability and renewable capability of organization. The strategic thinking capability is a kind of capability that can make the strategic management process with feedback, predictability and innovation, which can make the enterprises strategy capability to constantly innovate and improve. It consists of strategic thinking capability of decision-making level and executive staff [1], [8], [33]. Strategic resource management capability reflects the capability of enterprise to integrate internal and external resources and the ability to manage strategic resources. It mainly measures enterprises capability to obtain and use strategic resources, which involves in key elements such as strategic resource acquisition capability and strategic resource using capability [3], [9], [14]. The self-adaptability and renewable capability of organization can reflect if the enterprises have the flexibility and adaptability, constantly revised and improved organizational functions to adapt to a constantly changing environment. It mainly measures the capability of adaption and updating, which involves in key elements such as learning, coordination, adaptability and the dynamic capability [26], [34], [36].

Secondly, the organization dimension of e-commerce enterprises. Organization dimension is the guarantee of enterprises that plan, implement, monitor and control. With the gradual diversification of functions and services of e-commerce enterprises, the precondition of management orderly is to establish and improve the organization structure. According to the development trend of e-commerce, enterprises should adjust and reform the organization structure, improve various rules and regulations, achieve the unification planning of management, well-defined right and responsibility of organization and personnel at all levels and ensure the operation of the enterprises effectively.

Key process areas of organization capability. In this study, we pay attention to three process indicators to analyse, including standardization, rights distribution and complex/specialized. Standardization refers to the degree of standardization of the rule, procedure, instruction, command and controlling system in organization. It can reduce individual differences to influence the organization, including the type and the degree of standardization [2], [18]. Rights distribution mainly refers to the centralization of enterprises. Decision right is the most important element in the rights distribution. If majority of decisions are made by managers at the highest level, the enterprise is centralized which includes decision-making and behavior evaluation [12], [17], [49]. Complex/specialized. Complex refers to the organization’s activities or the number of subsystems. Specialized refers to division of labor, making the tasks of organization decompose into a single job to complete, including horizontal differentiation, vertical differentiation and ratio of professional and support staff [16], [19], [41].

Thirdly, the process capability of e-commerce enterprises. Process involves customers, suppliers and every detail of internal operations of enterprises. It is the mediation to connect different variable relations, which is one of the driving force of e-commerce enterprises. If an enterprise can realize its goal depends on completing the tasks of process on time and on quality or not largely. Effective process management is a guarantee of operational quality and efficiency to achieve.

Key process areas of process capability. We study key process areas of process capability focus on three key process indicators, which are rationalization, execution efficiency and flexibility. For rationalization, process design can help enterprises operate smoothly, relates to the match degree of the organizational structure, the improvement of the supervision mechanism and continuity of information transfer [6], [20], [32]. For execution efficiency, we consider the executive capability from top to bottom mainly which contains the decision support capability and target completion rate [22], [56]. For flexibility, which mainly refers to the responses of process to change, including strain capability and buffer capability [40], [45].

Fourthly, personnel capability of e-commerce enterprises. The talent demand of e-commerce enterprises is diverse and complex [27]. The personnel capability of e-commerce enterprises can be summarized as technology and business capability. Technology capability includes technical service and technical support capability. These people who own technology capability know the knowledge of e-commerce, computer network and international economic and trade are the main force to support enterprises to maintain technology leadership and competitive advantage. Business capability includes business services and business support capability. This kind of talent owns the knowledge of business management and so on, which is the core strength to maintain the normal operation of enterprises.

Key process area of personnel capability. We focus on three key indicators, which are personal quality, knowledge management and communication and coordination. Personal quality refers to the personal qualities and traits of technical staff and business staff within the enterprises, which includes innovation capability, technical capability, decision-making, in the
mind to bear capability, self-control capability, planning, execution and presentation capability [29], [31]. Knowledge management involves the capabilities of knowledge and learning of personnel, which includes vocational training, learning capability, summarizing experience and interactivity [7], [46], [57]. Communication and coordination involves not only the personal capability, but also perception and integration capability for enterprises and industry environment which includes the coordination, interpersonal skill, information communication, competition and cooperation and incentive and supervision [29].

Fifthly, IT capability of e-commerce enterprises. IT capability means the capabilities that an e-commerce enterprise to support and improve the business strategy and work process through acquisition, deployment, integration and deployment of IT resources [32]. E-commerce enterprises need to have a solid and standardized IT infrastructure and security and flexible system as its technical support, supporting for the rapid decision making and application of the strategy layer.

Key process areas of IT capability. We focus three key indicators on key process areas of IT capability, which are IT infrastructure, IT business across capability and IT business leading capability [28], [30]. IT infrastructure is mainly related to the software and hardware, networks and other infrastructure which includes the guarantee mechanism, early-warning mechanism, emergency mechanism and standardized to support IT operation. IT business across capability supports multi-sector cooperation, which includes collaboration and feedback mechanism. IT business leading capability means IT capability that can keep sustained competitive advantages of enterprises, which includes the agility and user demand guidance.

The capability maturity levels of e-commerce enterprises
Each level of the capability maturity model for e-commerce enterprises should have a series of distinguishable characteristics by empirical testing [35]. Maturity levels reflect the growth of e-commerce enterprises from start-ups to mature. The update of maturity represents the development and promotion of the management level of e-commerce enterprises.

According to CMM, the level of e-commerce enterprises capability maturity model is defined as five, including initial level, repeatable level, standardized level, managed level and optimized level. Enterprises can be improved by a series of small evolutionary steps forward to higher levels of maturity. Each maturity level and its characteristics like Table 4.

<table>
<thead>
<tr>
<th>Maturity level</th>
<th>Characteristics</th>
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</thead>
<tbody>
<tr>
<td>Initial level (ⅰ)</td>
<td>Competitiveness of enterprises at the lowest level; nature clear; internal management of enterprises in the initial stage without being institutionalized; managers are responsible for all or most of business; most business conducts random; enterprises in the cooperation are in a passive state.</td>
</tr>
<tr>
<td>Repeatable level (ⅱ)</td>
<td>Enterprises internal management begin to take order; have set up the related system; fuzzy responsibilities distribution; have owned some fixed business partners; enterprises can maintain operations by the earnings; no difference in technology and product and can be replaced any time; mainly by low prices and economics of scale for competitive strategy.</td>
</tr>
<tr>
<td>Standardized level (ⅲ)</td>
<td>Management level, products and services provided by equal to or greater than the industry average; can be used as a benchmark within the industry; with core competitiveness; can make sustainable improvements to achieve industry leader level.</td>
</tr>
<tr>
<td>Managed level (ⅳ)</td>
<td>Enterprises with clear strategy; focus on all aspects of enterprises management assessment; pay attention to details and actively improve; pay attention to objective management; correct any business which deviates from the objectives at any time; highly competitive in the industry; strong sense of crisis.</td>
</tr>
<tr>
<td>Optimized level (ⅴ)</td>
<td>A world class; have absolute competitive advantages; high efficiency; leading the industry development.</td>
</tr>
</tbody>
</table>

Source: collating of data by authors.

E-commerce enterprise capability maturity initial model
Based on analysis and elaboration for dimensions, key process areas and key process indicators and levels, we construct the e-commerce enterprises capability maturity initial model with five levels and five dimensions. See Table 5.
<table>
<thead>
<tr>
<th>Level</th>
<th>Organization capability</th>
<th>Strategy capability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial</td>
<td>No clear organization structure; decision making is centralized.</td>
<td>Relaying on decision makers will determine the strategy.</td>
</tr>
<tr>
<td>Repeatable</td>
<td>Basic organizational structure; decision-making level is low.</td>
<td>Executive level strategy thinking capability to increase; can obtain and use a small amount of strategy resources.</td>
</tr>
<tr>
<td>Standardized</td>
<td>Industry performance: proportion of professional and support staff; standardization level is the industry benchmark.</td>
<td>Executive level strategy thinking capability; better capability to obtain strategy resources; strong strategy updating capability.</td>
</tr>
<tr>
<td>Managed</td>
<td>Decision making level with a high level strategy thinking capability.</td>
<td>Decision making level with a high level strategy thinking capability.</td>
</tr>
<tr>
<td>Optimized</td>
<td>The type of organization structure and degree of standardization are suitable for horizontal and vertical management.</td>
<td>Update capabilities are very strong.</td>
</tr>
</tbody>
</table>

**Table 5:** E-commerce capability maturity model for enterprises
<table>
<thead>
<tr>
<th>Personal capability</th>
<th>Process capability</th>
</tr>
</thead>
<tbody>
<tr>
<td>flair for learning, knowledge management, and communication capability</td>
<td>flair for learning, knowledge management, and communication capability</td>
</tr>
<tr>
<td>Uneven personal qualities, knowledge management, and communication capability</td>
<td>Poor random business process, difficult to predict execution efficiency</td>
</tr>
<tr>
<td>Compared with business personal quality, higher requirements for technical personal</td>
<td>EXECUTION: some flexible: Needed management process, poor performance: Higher buffer capacity</td>
</tr>
<tr>
<td>Communication capability</td>
<td>Communication capability</td>
</tr>
<tr>
<td>Higher degree of collaboration, higher efficiency of information transfer</td>
<td>Higher efficiency of communication and coordination capability, good self-learning capability</td>
</tr>
<tr>
<td>Higher degree of collaboration, higher efficiency of information transfer</td>
<td>Higher efficiency of communication and coordination capability, good self-learning capability</td>
</tr>
<tr>
<td>With a super personal quality: can combine to absorb new knowledge and focus on a variety of areas, communication barrier-free, continuous improvement, business-oriented.</td>
<td>With a super personal quality: can combine to absorb new knowledge and focus on a variety of areas, communication barrier-free, continuous improvement, business-oriented.</td>
</tr>
<tr>
<td>IT capability</td>
<td>With essential support capability for business infrastructure; poor-low standardization</td>
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<tr>
<td>Early-warning and emergency response mechanism is</td>
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</table>

**CONCLUSION**

In view of the development trend of e-commerce and the uniqueness of the e-commerce enterprises, this study comprehensively applies the research results in the fields of innovation, strategy, organizational behavior, process reengineering, human resources and IT technology and finally proposes a basic frame of e-commerce enterprises capability maturity model. In the future, we will choose several representative e-commerce enterprises to study. On the base of recognition of e-commerce enterprises core competence we will evaluate the level of e-commerce enterprises capability maturity, further will modify and improve the e-commerce enterprises capability maturity model and give suggestions to how to improve the capability maturity level of e-commerce enterprises.

**REFERENCES**


RESEARCH ON THE CONSTRUCTION OF PERSONAS MODEL BASED ON K-MEANS CLUSTERING ALGORITHM

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ABSTRACT
As a model framework of outlining the network target group and locking user's demand trait, Personas can be used to reveal the characteristics and behaviors of the user efficiently and accurately. Setting the data of SINA Weibo users as research object, a comprehensive description of the multi-dimensional user characteristics as the main purpose, the K-means clustering algorithm as a technical means, this paper mines the user data deeply, then builds a Personas model, finally visualizes the results of Personas model based on Matlab. In this paper, the proposed method of building a Personas model provides a reference for practical application problems, such as the accurate locking of potential users and the targeted delivery of network advertising.

Keywords: K-means algorithm; Personas; High-precision classification

INTRODUCTION
In network economic era, the rapid development of “internet + trade” will drive user demand for personalized service underlined, and the main mission of network marketing becomes more and more focus on capturing the features of the user accurately. Customer analysis has been an important discussion of commodity sales area, especially under the network environment, customer analysis is influenced by statistic customer descriptive data and dynamic customer behavioral data, and consequently it has distinct features of big data analysis. User experience authority expert Alan Cooper for the first time to forward the concept of Personas[4]. Anhua Ma [1] divided Personas dimensions into static information and dynamic information in the design and implementation of precision marketing system, classified the required data of building Personas model; Mengjie Yu [3] makes use of statistical analysis, specific qualitative individual description and statistical thinking to put forward in product development to build Personas model; Shuguang Zhao [6] through in-depth interviews with 500 users of social media use motivation and behavior, divided social users into five categories by quantitative statistical analysis, and formed a rough Personas model. The Personas is a description of the specific details of the target user and a virtual representation of the user, which is based on a series of marketing data, usability data and other real data to build the target Personas model.

Setting the data of Sina Weibo users as research object, a comprehensive description of the multidimensional user characteristics as the main purpose, the K-means clustering algorithm as a technical means, this paper mines the user data deeply, then builds a Personas model, finally visualizes the results of Personas model based on Matlab, hope to be able to inspire the above questions.

DATA ACQUISITION
Scrapy [5] is a distributed crawler framework based on Python. It provides the abstract design of crawler, which can be easily and efficiently to crawl and analyze all kinds of data on the network. According to the attribute of the Weibo user to define item, spider, item pipeline and other items, access to Sina Weibo API interface, we can start data scrawling.

K-MEANS CLUSTERING ANALYSIS FOR DATASETS
Through the preprocessing for the original data, the final datasets includes 32,915 user data. For the data is scattered, it is unable to get the relationship and distinction between users. If clustering analysis [2] can be made of the user, just look at a certain class to know the feature of all the users within the class. In the case of no-class label information, clustering analysis groups things automatically to enable every group to identify themselves and distinguish from other groups, so this study makes clustering analysis of the user firstly.

The Andrews1 figure is used to show clustering results. As shown in Figure 1, every ribbon is on behalf of a class of user, and the wider the ribbon is, the more users is represented. Besides in figure 4, the t axis represents the observed value, and the f (t) axis represents a function of t.
From the effect diagram of K-means user clustering, the users whose data is centralized are showing five kinds of features:
The first kind of users: male users who are about 35 years old have quite low influence and active degree, and are from non-mobile platform.

The second kind of users: young female users who are 28 years old have quite high influence and active degree, and are from mobile platform.

The third kind of users: young male users who are 19 years old have low influence and active degree, and are from non-mobile platform.

The fourth kind of users: middle-aged male users who are 45 years old have very high influence and active degree, and are from non-mobile platform. This kind of users is the opinion leaders of Weibo.

The fifth kind of users: young female users who are 22 years old have general influence and active degree, and are from mobile platform.

Up to this point, preliminary clustering of Weibo user is finished.

**USER LABEL ANALYSIS**

The user label is a static data that can represent the user’s personal characteristics. This study will be based on the five categories of user labels that are classified by K-means clustering, and then obtain the information to improve the user’s characterization. Specific processing steps are as follows:

1. A label for each user (a single user can have multiple labels) in a two-dimensional table, each row in a table represents a user's label.

(2) for the user's label, because the label is too mixed, the research will be carried out by the user label and delete the independent label, a total of 8 categories of labels. Each user's label is divided into the 8 categories according to the subject characteristics, and the number of users per class label.

(3) through the data perspective table, 32915 users of each user's label categories and their number, and then combined with the data analysis of the 5 categories of clustering results, 5 types of basic user's label categories and specific numbers, as shown in table 1:

<table>
<thead>
<tr>
<th>Label</th>
<th>1st</th>
<th>2nd</th>
<th>3rd</th>
<th>4th</th>
<th>5th</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food</td>
<td>492</td>
<td>1247</td>
<td>1723</td>
<td>313</td>
<td>1790</td>
</tr>
<tr>
<td>Film</td>
<td>141</td>
<td>511</td>
<td>1175</td>
<td>27</td>
<td>911</td>
</tr>
<tr>
<td>Sports</td>
<td>131</td>
<td>349</td>
<td>445</td>
<td>64</td>
<td>590</td>
</tr>
<tr>
<td>Games</td>
<td>0</td>
<td>133</td>
<td>451</td>
<td>0</td>
<td>339</td>
</tr>
<tr>
<td>Digital</td>
<td>261</td>
<td>492</td>
<td>550</td>
<td>119</td>
<td>782</td>
</tr>
<tr>
<td>Car</td>
<td>153</td>
<td>274</td>
<td>304</td>
<td>69</td>
<td>411</td>
</tr>
<tr>
<td>Dress</td>
<td>352</td>
<td>1339</td>
<td>1484</td>
<td>288</td>
<td>1740</td>
</tr>
</tbody>
</table>

Table 1. User Label Statistics
By Table 1, the number of "music" labels is far more than the rest of the labels, and then dress and food. Although the multi label is helpful to accurately portray the microblogging users, but the post ranking label has a low impact, too many labels will also give users a picture after the application inconvenience. Therefore, on this basis, this study selects the top four of the label to reveal the user portrait.

Such as the first category of user groups, the top four of its users for food, clothing, music and digital, you can describe the type of user attention fashion, focus on quality of life of a class of people. The rest of the 4 categories can be described in accordance with this idea of the user, specifically see table 2:

<table>
<thead>
<tr>
<th>Label 1</th>
<th>1st</th>
<th>2nd</th>
<th>3rd</th>
<th>4th</th>
</tr>
</thead>
<tbody>
<tr>
<td>Label 2</td>
<td>Dress</td>
<td>Food</td>
<td>Food</td>
<td>Dress</td>
</tr>
<tr>
<td>Label 3</td>
<td>Music</td>
<td>Music</td>
<td>Dress</td>
<td>Music</td>
</tr>
<tr>
<td>Label 4</td>
<td>Digital</td>
<td>Film</td>
<td>Film</td>
<td>Digital</td>
</tr>
</tbody>
</table>

**USER BEHAVIOR ANALYSIS**

After the user's static characteristics extracted from the user's labels, then the analyzed user's behavior data to get user dynamic features.

In this study, we use the data perspective to analyze the regional distribution of the Weibo users, as shown in Figure 2:

![Figure 2. Weibo User Area Map](image)

All kinds of user area distribution map is as follows:

![Figure 3. Five types of user area distribution map](image)
It can be seen from the picture above that in the wider region of Guangzhou, Shanghai and Beijing, Weibo users are more concentrated, these regions are densely populated areas. The rest of the regional Weibo users basically uniform distribution, the deviation is not large.

Secondly, for the analysis of the Weibo user search keywords, the same as user label analysis, the study extract and statistics keywords. Use frequency in the first three words as the user behavior features, as shown in the following table:

<table>
<thead>
<tr>
<th>Keyword 1</th>
<th>1st</th>
<th>2nd</th>
<th>3rd</th>
<th>4th</th>
<th>5th</th>
</tr>
</thead>
<tbody>
<tr>
<td>Music</td>
<td>Music</td>
<td>Clothes</td>
<td>Computer</td>
<td>History</td>
<td>Snacks</td>
</tr>
<tr>
<td>Education</td>
<td>iphone</td>
<td>Food</td>
<td>Book</td>
<td>Li Jian</td>
<td>Li Jian</td>
</tr>
<tr>
<td>Xiaomi</td>
<td>Travel</td>
<td>Guitar</td>
<td>Western-style Clothes</td>
<td>Meizu</td>
<td>Meizu</td>
</tr>
</tbody>
</table>

PERSONAS MODEL CONSTRUCTION

Through K-means clustering algorithm is used for static feature extraction and dynamic behavior mining to user data above, the Personas formed has the data support and the rich, and meet the basic requirements of the Personas principles by Alan Cooper basically. Sina Weibo users whose raw data is centralized are divided into five categories of user groups subtly:

The first category of users: male users who have quite low influence and activeness age in 31 and 35 years old, and use non-mobile platform; individual label category: Food, Dress, Music, Digital; search keywords category: Music, Education, Xiaomi.

The second category of users: young female users who are not the opinion leaders of Weibo have quite high influence and activeness, age in 26 and 30 years old, use mobile platform; individual label category: Dress, Food, Music, Digital; search keywords category: Clothing, iPhone, Travel.

The third category of users: young male users who have low influence and activeness age in 16 and 20 years old, and use non-mobile platform; individual label category: Music, Food, Dress, Film; search keywords category: Computer, Food, Guitar.

The fourth category of users: middle-aged male users who are the opinion leaders of Weibo have very high influence and activeness, age in 41 and 45 years old, use non-mobile platform; individual label category: Food, Dress, Music, Digital; search keywords category: History, Book, Western-style Clothes.

The fifth category of users: young female users who have general influence and activeness in 21 and 25 years old, and use mobile platform; individual label category: Food, Dress, Music, Film; search keywords category: Snack, Li Jian, Meizu.

Visual performance of these five classes of users is shown in figure 4:

![Personas](image1)

**Figure 4. Sina Weibo user Personas Model**

CONCLUSION

Personas model getting through the above process can accurately classify the user, describe the user features in detail, solve the problem of understanding user behavior.
problems arising from the user classification before. It is a better user positioning method. Broadly speaking, any need to locate users precisely or virtual users is able to use personas model to realize. Building network personas model provides a necessary reference for accurately delivering network marketing.

REFERENCES
[6] Shuguang Zhao.(2014) 'High conversion of social media users portrait: Based on the deep interview of 500 users', Modern communication (Journal of Communication University of China), No. 6, pp. 115-120.
SEARCH CONSTRAINT OF MOBILE TECHNOLOGY AND CHANNEL CHOICE IN E-COMMERCE

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ABSTRACT

This study aims to investigate empirical evidence of search constraints of the mobile technology from the theoretical lens of technology affordance. Using a large archival panel dataset encompassing transactions in the PC and mobile channels, we find that information-intensity of products is negatively associated with the choice probability of the mobile channel over the PC channel. However, the negative association is weakened as the user experience in the mobile channel accumulates, suggesting a dynamic relationship between user and technology (i.e., users’ learning or adaptation to technology).

Keywords: Mobile channel, search constraint, e-commerce, channel choice, technology affordance

INTRODUCTION

Mobile technologies are transforming e-commerce markets. The mobile channel has rapidly been established as a major transaction channel, possibly substituting for or complementing existing channels. Mobile technologies are also transforming user behaviors. While the mobile channel provides a higher level of spatially flexible access vis-à-vis the online channel (ubiquitous access capability of the mobile channel), it is still limited in terms of information search-related usability vis-à-vis the PC channel (limited information search capability of the mobile channel) [1].

This study aims to investigate empirical evidence of search constraints of the mobile channel from the theoretical lens of technology affordance. As Orlikowski [16] underlines, “[users’] understandings of technology are neither fixed nor universal, but … they emerge from situated and reciprocal processes of interpreting and interacting with particular artifacts over time” (p.8). Therefore, users’ electronic channel usage is not a static or deterministic outcome resulting from their profile, preexisting needs, or technology features, but flexible and dynamic decisions that can change with their usage context and experience. The notion of technology affordance provides more flexible approach to the issue than media theories [4][5] or channel capability theories [1], which posit each medium has invariant communication capacities or technological features. Rather than solely focusing on the role of technological features and deterministic relationship between the user and technology, the affordance lens can guide us to explore interplays between them.

We examine users’ purchase channel choices between the PC and mobile channels while taking account of the information-intensity of the products. If limited user interfaces of mobile devices indeed hinder extensive information search in the mobile channel, the mobile channel would be less preferred for transacting information-intensive products. However, according to the technology affordance, this search constraint would be dynamic as the user experience with the technology accumulates. A user might feel some difficulty in purchasing products on small mobile screen at her first attempt, but will find it easier to do next time. Therefore, we also examine users’ adaptation to the mobile channel by looking at the behavioral dynamics in sequences of choices over time, i.e., how the channel choice probabilities evolve as a user’s purchase experience in the mobile channel accumulates.

The rest of the paper is organized as follows. We present theoretical background of the study and develop hypotheses. Next, we conduct empirical analyses by applying a random coefficient Bayesian logit model to a large scale transaction dataset from an e-market. We conclude by discussing implications of the study.

THEORETICAL BACKGROUND AND HYPOTHESES

Channel Choice

Researchers have widely discussed consumers’ purchase behaviors in a multi-channel environment, primarily on their channel choices [3][7][13]. A common lesson from these studies is that channel choice is not a straightforward decision. There are a variety of factors that can affect the choice, such as transaction costs [2], channel-category associations and geodemographics [10], informational trust and convenience [3], and consumers’ information needs and information retrieval from channels [13]. Also, the probability of the choice can change over time as consumers’ experiences in each channel accumulated [17][19].

Although prior studies present useful insights regarding consumers’ purchase behaviors in a multi-channel environment, there are important gaps in the literature. First, most studies have analyzed purchase behaviors between offline, online, and catalog channels, leaving out mobile channels. Second, prior studies provide limited guidance on the relationship between product category and channel choice because their analyses usually focus on a single product category [3][13][19]. A notable exception is Inman et al. [10] who focused on associations between product categories and offline channels (drug store, mass store, club store, and grocery store). They showed that consumers’ channel choice decisions are significantly different across product

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categories, and that geodemographic factors can play an important role in explaining channel shares of volume; however, such factors are not applicable to the case of channel choices between the PC and mobile channels, both of which are electronic media to which physical distance to a shop is irrelevant.

**Search Constraint of Mobile Channel and Purchase Channel Choice**

While a variety of types of information are available to e-market users, including product descriptions, customer reviews, price information, and delivery and return policies, all of the information is not critical to all product categories that consumers evaluate. Some product categories (e.g., home furniture or cameras) involve extensive searches in terms of the number of pages viewed and the total time spent on search, whereas other categories (e.g., health or beauty products) entail much less extensive searches [9].

Product information-intensity refers to “the amount of information a consumer needs to process before making purchase decisions” [1]. Other things being equal, information-intensive products are likely to lead to more in-depth searches and/or broader searches for product information. Given the search constraints of the mobile channel, the information-intensity of a product may affect which channel consumers would prefer to use. The search constraints of mobile channels would be critical to e-market users’ channel choices when purchasing products with high information-intensity, while the users might be affected less by the search constraints when purchasing products with low information-intensity. However, the search constraints do not remain constant, as suggested by the technology affordance perspective [14][15][16]. Users could adapt to purchasing products on small screens and limited user interfaces in mobile channels. As their purchase experiences in mobile channels accumulate, they would get accustomed to interacting with mobile screens and purchasing products using mobile devices. The authors’ anecdotal evidence from an interview with a manager of an e-market supports this point.

“We are surprised that our customers begin to purchase big ticket items in the mobile channel. Although still negligible comparing to online sales, products like TV, laundry washing machine, and refrigerator are now being sold through the mobile channel, and the number is going up beyond our prior expectation.”

The above discussion leads to the following hypotheses:

**H1.** Information-intensity of products is positively associated with the choice of PC channel over the mobile channel.

**H2.** The association between information-intensity and channel choice is weakened as the user experience in the mobile channel accumulates.

**EMPIRICAL ANALYSIS**

**Data**

This study employs a large dataset from a major e-marketplace in South Korea, which introduced the mobile channel on June 1, 2010 to its more than ten million users of the existing PC channel. The dataset contains a random sample of 30,000 users, who adopted the mobile channel before June 1, 2011, and their entire online orders (1.18 million) and mobile orders (0.11 million) placed during March 1, 2009-June 1, 2011. The dataset consists of a variety of variables related to each order including the product category, price, order time, and order channel (PC or mobile).

Since our interests lie in channel choices of users, 24,684 users who had less than four mobile transactions after they made their first transaction in the mobile channel were excluded from the analysis. Further, 72 business users were also dropped. Remaining 5,244 users and their entire 155,091 order records after their mobile channel adoptions were used for the analysis.

Table 1 shows descriptive statistics of the main data. The data consists of 98,045 online and 57,046 mobile orders. The average price of mobile orders was significantly less than that of online orders (the difference = 5.8, t = 14.47, p = 0.001), indicating that products transacted through the mobile and online channels could be different. A chi-square test on orders by hour of day also shows that there were significant differences between mobile and online channels in terms of order time ($\chi^2(23)=1.3e+03$, $p < 0.001$). Among the 5,244 users, there were 2,826 female and 2,418 male users, and most of them were less than or equal to 35 years old. The average membership duration for the e-marketplace was 733.6 days.

To measure the number of attributes of a product, we gathered data from another e-marketplace, Danawa.com, where the attribute information of a product is provided using the attribute discriminator of slash (’/’) as shown in Figure 1. For example, if a product has three attributes A, B, and C, then the attribute information would be shown as A / B / C. The upper product in Figure 1, a desktop computer by Samsung Electronics, has 11 pieces of attribute information including ‘Intel,’ the CPU maker, ‘Core i5-4590 (3.3GHz),’ the CPU model, ‘2GB,’ the main memory size, ‘DDR3,’ the main memory type, etc. Similarly, the lower product in Figure 1, a HP desktop computer, has 17 pieces of attribute information.

We counted the number of the attributes for each product listed in the first page for each product category and then averaged the numbers because products in a category may have different number of attributes. The average was used as a proxy measure for the information-intensity of the product category.

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### Table 1. Basic Description on Data

<table>
<thead>
<tr>
<th>Total Number of Orders</th>
<th>155,091</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of orders</td>
<td>98,045</td>
</tr>
<tr>
<td>Average order prices in USD (Std.)</td>
<td>28.2 (90.5)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Number of orders by hour of day</th>
<th>Online Orders</th>
<th>Mobile Orders</th>
</tr>
</thead>
<tbody>
<tr>
<td>00h</td>
<td>5,493</td>
<td>2,821</td>
</tr>
<tr>
<td>01h</td>
<td>3,990</td>
<td>2,350</td>
</tr>
<tr>
<td>02h</td>
<td>2,466</td>
<td>1,402</td>
</tr>
<tr>
<td>03h</td>
<td>1,947</td>
<td>1,017</td>
</tr>
<tr>
<td>04h</td>
<td>1,171</td>
<td>688</td>
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<tr>
<td>05h</td>
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<td>560</td>
</tr>
<tr>
<td>06h</td>
<td>912</td>
<td>663</td>
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<td>07h</td>
<td>1,278</td>
<td>1,088</td>
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<td>08h</td>
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<td>10h</td>
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<td>15h</td>
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<td>5,230</td>
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<td>17h</td>
<td>5,060</td>
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<td>18h</td>
<td>4,592</td>
<td>2,402</td>
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<td>19h</td>
<td>4,189</td>
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</tr>
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<td>6,555</td>
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</tr>
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<td>23h</td>
<td>7,361</td>
<td>3,302</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Total Subjects</th>
<th>5,244</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Gender</th>
<th>Female</th>
<th>Male</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2,826</td>
<td>2,418</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Age</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>≤ 20</td>
<td>398</td>
</tr>
<tr>
<td></td>
<td>21~25</td>
<td>1,376</td>
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<tr>
<td></td>
<td>26~30</td>
<td>1,635</td>
</tr>
<tr>
<td></td>
<td>31~35</td>
<td>951</td>
</tr>
<tr>
<td></td>
<td>36~40</td>
<td>487</td>
</tr>
<tr>
<td></td>
<td>41~45</td>
<td>172</td>
</tr>
<tr>
<td></td>
<td>46~50</td>
<td>95</td>
</tr>
<tr>
<td></td>
<td>51≤</td>
<td>130</td>
</tr>
</tbody>
</table>

Average membership duration in days (std.)\(^1\) 733.6 (307.7)

**Note:** \(^1\) Duration as of June 1, 2011.
Model Specification

We consider a channel choice function of a user with covariates of information-intensity of product, user experience in the mobile channel, and purchase time. This can be modeled as a binary choice. The utility of mobile channel choice for user \( i \) at choice \( k \), \( U_{ik} \), is given by

\[
U_{ik} = x_{ik} \beta_i + z_{ik} \gamma_i + \epsilon_{ik}
\]

(1)

where the \( x_{ik} \) represents variables that vary with only choices (i.e., order time), the \( z_{ik} \) represents variables that vary with users and choices (i.e., user experience), and the error term is assumed to follow i.i.d. Gumbel type II extreme value distribution.

We have three sets of variables that could influence users’ channel choice behavior. The first set of variables is the order time, \( T_{ik} \), which is a dummy variable representing whether the user \( i \) made the order of the \( k \)-th choice at hour (of day) \( t \). As shown in Bang et al. (2014), access affordance of the mobile channel affects purchase time; therefore purchase time should be controlled for in the choice model. To this end, a total of 23 dummies, \( t = 0, 1, \ldots, 22 \), were employed. For example, \( (T_{0i}, T_{1i}, \ldots, T_{22i}) = (0, 0, \ldots, 0) \) represents that a purchase made between 23h and 00h, and \( (T_{0i}, T_{1i}, \ldots, T_{22i}) = (1, 0, \ldots, 0) \) represents a purchase made between 00h and 01h.

The second set of variables is the measures for information-intensity of the purchased product. We use two objective measures of the information-intensity: the number of product attributes (or bulleted descriptions) and the product price. The number of product attributes is widely used or recognized as the proxy for the amount of information that should be processed before a purchase [9] [11]. Sellers provide information on product attributes to help consumers make purchase decisions. A TV seller, for example, provides product information such as brand, type, display technology, screen size, and resolution, all (or some) of which might be considered as the input for our purchase decision. As explained in the preceding subsection, we employ a proxy measure \( AATT_{ik} \), the average number of attributes of the purchased product category at the \( k \)-th choice of user \( i \).

We also took the product price (\( PRI_{ik} \)) as the proxy measure for the information-intensity of the product. Consumers typically spend more time for information search when purchasing expensive products. Prior studies also empirically confirmed that product price is an important determinant of search intensity across a variety of product categories [12]. \( PRI_{ik} \) is the product price at the \( k \)-th choice of user \( i \).

The third one is the transaction experience in the mobile channel. Prior studies suggest consumers’ channel choice probabilities change as their experience in the channel accumulates [17]. In order to explore the behavioral dynamics in sequences of choices over time, we include \( EXP_{ik} \), the number of transactions made through the mobile channel before the \( k \)-th choice of the user \( i \).

Furthermore, it would be unrealistic to assume that channel choices by the same user are uncorrelated with given observed covariates. To control for unobserved heterogeneities, we employed a random coefficient Bayesian logit model. The model allows us to control for effects from individual-specific time-invariant factors on the channel choice (preference heterogeneity) with individual (user)-specific intercepts. Also, the model considers heterogenous effects of covariates across users using random coefficients.

The affordance perspective suggests that technology constraint is not at a standstill, but changes as users adapt to the technology.
For example, a user might feel difficulty in purchasing products on the small mobile screen at his first attempt, but may find easier to do it next time. To capture the changing nature of the associations between the covariates and channel choices, we included interaction terms between EXP and other two covariates AAT, and PRI in the model.

Then, the model specification is:

$$\logit(\pi_{ik}) = \beta^{PRI}_{i} PRI_{i} + \beta^{AAT}_{X} AAT_{X} + \beta^{EXP}_{X} EXP_{X} + \sum_{t=0}^{22} \tau_{it} + \beta^{PRI}_{i} EXP_{i} PRI_{i} EXP_{i} + \beta^{AAT}_{X} EXP_{X} PRI_{i} AAT_{X} EXP_{X} + \alpha_{i} + u_{ik} \quad (2)$$

where $\pi_{ik}$ is the conditional probability that user $i$ chooses the mobile channel at $k^{th}$ choice, $\beta^{X}$ is the coefficient of covariate $X \in \{AAT, PRI, EXP\}$ for user $i$, $\tau_{i}$ is the coefficient for the transaction hour of day, $\alpha_{i}$ is the individual fixed effect, and $u_{ik}$ is the error term.

**Results**

Table 2 shows the analysis results from the random coefficient Bayesian logit model.

The effects of the product price and the number of product attributes, two proxy variables measuring the information-intensity of the purchased product, are negative and significant. This result presents empirical evidence of search constraint of the mobile channel, thereby supporting H1. We also note that the effect of the mobile channel transaction experience is positive and significant, indicating users are more likely to choose the mobile channel as their transaction in the mobile channel accumulates.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Null Model</th>
<th>Main Model</th>
<th>Interaction Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRI</td>
<td>-0.030 (0.000)**</td>
<td>-0.020 (0.000)**</td>
<td></td>
</tr>
<tr>
<td>AAT</td>
<td>-0.961 (0.022)**</td>
<td>-1.001 (0.020)**</td>
<td></td>
</tr>
<tr>
<td>EXP</td>
<td>0.021 (0.000)**</td>
<td>0.054 (0.012)**</td>
<td></td>
</tr>
<tr>
<td>PRI * EXP</td>
<td></td>
<td>7.2E-4 (1.2E-4)**</td>
<td></td>
</tr>
<tr>
<td>AAT * EXP</td>
<td></td>
<td>0.014 (0.000)**</td>
<td></td>
</tr>
<tr>
<td>Hour1</td>
<td>0.183 (0.044)**</td>
<td>0.177 (0.044)**</td>
<td>0.178 (0.044)**</td>
</tr>
<tr>
<td>Hour2</td>
<td>0.218 (0.051)**</td>
<td>0.221 (0.052)**</td>
<td>0.222 (0.052)**</td>
</tr>
<tr>
<td>Hour3</td>
<td>0.184 (0.058)**</td>
<td>0.192 (0.058)**</td>
<td>0.192 (0.058)**</td>
</tr>
<tr>
<td>Hour4</td>
<td>0.216 (0.068)**</td>
<td>0.203 (0.069)**</td>
<td>0.204 (0.069)**</td>
</tr>
<tr>
<td>Hour5</td>
<td>0.388 (0.075)**</td>
<td>0.368 (0.075)**</td>
<td>0.368 (0.075)**</td>
</tr>
<tr>
<td>Hour6</td>
<td>0.510 (0.072)**</td>
<td>0.498 (0.072)**</td>
<td>0.498 (0.072)**</td>
</tr>
<tr>
<td>Hour7</td>
<td>0.600 (0.060)**</td>
<td>0.604 (0.060)**</td>
<td>0.604 (0.060)**</td>
</tr>
<tr>
<td>Hour8</td>
<td>0.417 (0.052)**</td>
<td>0.415 (0.053)**</td>
<td>0.417 (0.053)**</td>
</tr>
<tr>
<td>Hour9</td>
<td>0.502 (0.046)**</td>
<td>0.502 (0.046)**</td>
<td>0.502 (0.046)**</td>
</tr>
<tr>
<td>Hour10</td>
<td>0.329 (0.043)**</td>
<td>0.328 (0.043)**</td>
<td>0.328 (0.043)**</td>
</tr>
<tr>
<td>Hour11</td>
<td>0.720 (0.039)**</td>
<td>0.606 (0.039)**</td>
<td>0.604 (0.039)**</td>
</tr>
<tr>
<td>Hour12</td>
<td>0.286 (0.041)**</td>
<td>0.279 (0.041)**</td>
<td>0.280 (0.041)**</td>
</tr>
<tr>
<td>Hour13</td>
<td>0.247 (0.040)**</td>
<td>0.252 (0.040)**</td>
<td>0.252 (0.040)**</td>
</tr>
<tr>
<td>Hour14</td>
<td>0.236 (0.041)**</td>
<td>0.247 (0.041)**</td>
<td>0.248 (0.041)**</td>
</tr>
<tr>
<td>Hour15</td>
<td>0.235 (0.041)**</td>
<td>0.241 (0.041)**</td>
<td>0.242 (0.041)**</td>
</tr>
<tr>
<td>Hour16</td>
<td>0.186 (0.041)**</td>
<td>0.194 (0.041)**</td>
<td>0.194 (0.041)**</td>
</tr>
<tr>
<td>Hour17</td>
<td>0.121 (0.042)**</td>
<td>0.124 (0.042)**</td>
<td>0.124 (0.042)**</td>
</tr>
<tr>
<td>Hour18</td>
<td>0.010 (0.043)</td>
<td>0.008 (0.043)</td>
<td>0.009 (0.043)**</td>
</tr>
<tr>
<td>Hour19</td>
<td>-0.092 (0.044)**</td>
<td>-0.086 (0.045)</td>
<td>-0.085 (0.045)</td>
</tr>
<tr>
<td>Hour20</td>
<td>0.010 (0.043)</td>
<td>0.012 (0.043)</td>
<td>0.012 (0.043)</td>
</tr>
<tr>
<td>Hour21</td>
<td>-0.003 (0.041)</td>
<td>0.007 (0.041)</td>
<td>0.007 (0.041)</td>
</tr>
<tr>
<td>Hour22</td>
<td>-0.092 (0.040)**</td>
<td>-0.087 (0.040)**</td>
<td>-0.086 (0.040)**</td>
</tr>
<tr>
<td>Hour23</td>
<td>-0.082 (0.039)**</td>
<td>-0.077 (0.039)**</td>
<td>-0.076 (0.039)**</td>
</tr>
</tbody>
</table>

**Note:** within *95%, **99%, ***99.9% credible intervals
To examine the user adaptation to the mobile channel, we incorporate two interaction terms between the transaction experience in the mobile channel and the measures for the information-intensity of the purchased product. The interaction term between the price and the experience is positive and significant, indicating that the negative association between the product price and the mobile channel choice is weakened as user experience in the mobile channel accumulates. The interaction term between the number of product attributes and the experience is also positive and significant, meaning that the negative association between the number of product attributes and the mobile channel choice become weaker as user experience in the mobile channel increases. Positive and significant coefficients of both interaction terms collectively provide empirical evidence of user adaptation to the mobile channel, supporting H2.

**DISCUSSION AND CONCLUSION**

In this study, we empirically examined the search constraint of the mobile channel in e-commerce. Using a large scale archival dataset from a sample of mobile channel users encompassing their e-commerce transactions in the PC and mobile channels, we investigated the relationship between information-intensity of products and users’ purchase channel choices between the PC and mobile channels.

We demonstrate search constraints of the mobile channel with the negative association between the product information-intensity and the likelihood of mobile channel choice. Furthermore, the result suggests the dynamic relationship between user and technology (i.e., users’ learning or adaptation to technology), which is another important aspect of technology affordance. That is, limited mobile user interfaces could become less of an obstacle or could even be overcome as users gain more experience in the mobile channel.

This study contributes to the technology affordance literature by offering empirical evidence of search constraint of mobile technologies in the context of e-commerce and demonstrating its time-varying impact on technology use. Another important argument of the literature is that the realization could be dynamic as user experience with technology accumulates [6] [18]. The positive and significant coefficients of the interaction terms between user’s mobile transaction experience and the information-intensity measures indicate the learning process in the mobile channel.

This study also provides important managerial implications. It shows that e-market users are more likely to purchase information-intensive products through the PC channel, but this tendency has weakened as their mobile shopping experience accumulates. E-marketplace such as Amazon or Taobao could better capitalize on their mobile user bases by offering different goods according to each user’s experience in the mobile channel. They could present less information-intensive products (e.g., toilet paper) to new mobile channel adopters, while more information-intensive products (e.g., travel packages) to experienced mobile users.

**ACKNOWLEDGEMENT**

This work was supported by the National Research Foundation of Korea Grant funded by the Korean Government (NRF-2012S1A2A1A01031796).

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The Fifteenth International Conference on Electronic Business, Hong Kong, December 6-10, 2015


SOCIAL NETWORKS AND ONLINE GAMER LOYALTY

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ABSTRACT
Online social networks are popular issues in electronic commerce and information systems areas. However, the social network issues have received relatively little attention from scholars in online gaming contexts. Online games experience a strong growth in revenue and popularity. Therefore, this study chose to focus on social networks in online games. In online gaming studies, online gamer loyalty has been one of the recent issues. Therefore, this study consulted classic psychological theories to construct a theoretical model which contains specific hypotheses to explain how social networks impact the formulation of online gamer loyalty.

This study collected the responses from more than one thousand online gamers. The demographic and gaming behavior distributions resemble those of the online gamer populations, indicating the representativeness of the study sample. This study used measurement items from the literature and slightly modified them according to the research contexts. This study used confirmatory factor analysis and various indices to verify the measurement psychometric properties, including reliability, validity, and model fit. The analytical results supported adequate psychometric properties of the measurement used in this study.

Moreover, this study used the structural equation modeling technique to examine the study hypotheses. The analytical results indicated that the hypothesized aspects of social networks impact online gamer loyalty, as predicted. Furthermore, this study examined the mechanism underlying such impact.

This study is the first one examining how the hypothesized aspects of social networks contribute to the development of online gamer loyalty. Findings of this study provide insights for managers of electronic business (i.e., e-business) managers to retain loyal gamers, sustain stable revenues, and build competitive advantages, demonstrating the relevance of this study to e-business managers.

Keywords: Electronic business, online game, social network, loyalty, structural equation modeling
SUPPLY CHAIN REACTIONS TO THE RISE OF THE INTERNET OF THINGS: RESELLER ADOPTION OF SMART MICROGRID SOLUTIONS

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ABSTRACT
This study applies technology adoption and strategic orientation theories to investigate the reseller adoption of smart microgrids (SMGs). These intelligent power generation solutions, operating on the Internet of Things (IoT) technology, rely on sustainable energy sources to supply small-scale loads. Using data from 100 power system resellers in North America, the study reveals that resellers’ performance expectancy and vendors’ innovation orientation foster reseller adoption of SMG solutions, while adoption is not driven by resellers’ effort expectancy. Furthermore, supply chain members play a crucial role in IoT technology diffusion, but the existing research lacks comprehensive models to help illuminate reseller adoption.

Keywords: Internet of Things, Smart microgrid, Reseller, Innovation orientation, Technology adoption

INTRODUCTION
There is an increasing interest in factors influencing the success of innovation diffusion and technology adoption [27]. In the field of clean energy, smart grids have surfaced as a prominent technology for distributed generation of energy [47]. They are distributed power generation systems that aggregate alternative and renewable energy sources, e.g. microturbines, fuel cells, wind systems, and photovoltaic systems, and employ bidirectional flows of electricity and communications to provide power and reduce peak load and energy losses [12]. Smart microgrids (SMGs) are solutions to small-scale local power generation based on smart grid technology. They have the capability to power by remote control and automate energy generation near demand [40]. SMGs can operate autonomously and disconnected from traditional grids, using local energy generation in times of power outages. They are important in the evolution of the Internet of Things (IoT) [12], as smart grids provide power utilities with digital intelligence and support millions of remote-intelligent devices, all connected through smart concentrators [48]. The intelligence from the data center to the edge means that these devices form intelligent networks that allow electric companies to manage the flow and consumption of energy [40]. The smart grid is a self-healing network that uses energy management system to restore itself [65].

The adoption of SMGs will have a great impact on the diffusion of IoT technologies in the power industry, as local and small-scale energy solutions are an important element of future energy systems [31]. These systems are based on intelligent control and monitoring capabilities, and can be connected with subsystems in local facilities. In spite of the benefits smart grids provide as a combination of power networks and communication networks, the market has not widely adopted SMGs [55]. They probably need more thorough consideration compared to conventional technologies [54]. Although recent studies have addressed the adoption of SMGs among stakeholders [28] and users [2], prior research lacks insight into the factors that affect the adoption of smart grid technology among supply chain members. This gap is notable, as the number of intermediaries within supply chains in the power industry is expected to grow, due to the opportunities provided by smart energy distribution systems [30]. While users and resellers evaluate the expected value of smart grids or other intelligent technology on different grounds, their underlying differences in adoption are not well understood. In particular, previous research has largely neglected the factors that affect reseller adoption of novel technology [58] and the role of vendor’s intervention in the technology adoption process [60].

This study extends the existing research on technology adoption by focusing on the role of supply chains in the diffusion of IoT-based power systems technology. The lack of research on reseller adoption of technology is surprising given that resellers are essential supply chain intermediaries between vendors and end customers [7] and downstream channels help to diffuse innovations to markets [41]. There is a need for research on reseller intentions to become involved in a technology and the ways the technology vendor might advance these intentions. Hence, we address the role of vendor’s intervention for reseller adoption through vendor’s innovation orientation, which is a strategic orientation that explains why firms differ from each other in terms of how they compete in the market [16] and that aims at discovering and satisfying emerging customer needs with novel technology [33]. The study analyzes survey data from 100 North American power system resellers to examine these relationships.

SMART MICROGRIDS AND THE INTERNET OF THINGS
Smart microgrids integrate “green,” smaller-capacity electricity sources (e.g. solar panels) in the grid, and apply IoT technologies to the operation and creation of intelligent services. As SMGs employ a two-way flow of electricity and information [6], the communication system is the key component of the smart grid technology infrastructure [59]. This bi-directional communication ability enables control of the local power system, reliability of operations, balancing of loads, and production of data for analytics.
and enables users to effectively respond to energy shortages by lowering their energy consumption [51]. Smart microgrids require real-time information management, which is crucial for the reliable delivery of power from the generating units to the users [59].

In spite of the benefits, smart grid technology provides, the adoption of SMGs remains limited [8]. SMG solutions can be adopted by diverse actors, including utility companies, universities, neighborhoods, companies, hospitals, and individuals. Excess energy produced by these actors can be stored during lower-demand times and used during peak demand periods or sold into the grid [15]. Changes in energy production and consumption require technical changes and social and cultural changes. Alvial-Palavicina and colleagues [6] argue that the adoption of SMGs depends on the characteristics of each adopting actor, but can be enhanced by the social intervention and understanding of the adopters’ expectations associated to the complexity of the technology [6]. Feedback and trust enhance stakeholders’ ability to communicate with each other, thereby reducing conflicts in regard to adopting novel technology [6]. Nonetheless, technology adoption is a highly complicated issue and needs more comprehensive research.

ADOPION OF SMART MICROGRID TECHNOLOGY
Technology adoption models are among the most influential [22] [36] theoretical frameworks for studying information technology usage. The Technology Acceptance Model (TAM) [18] and the Unified Theory of Acceptance and Use of Technology (UTAUT) [63] explain the information technology usage decisions in a variety of contexts and in relation to different types of technology [36]. Such models underline that individual attitudes toward information technology use precede intentions to use the technology, which in turn precede the actual use of the technology [63]. However, technology adoption studies have largely neglected supply chain members as adopters. This is a significant gap, since the number of intermediaries within supply chains in the power industry is expected to grow due to the opportunities that smart energy distribution systems offer [30]. In particular, research has not focused sufficiently on the peculiarities of reseller adoption compared to user adoption [4].

We address two gaps in the technology adoption theory: i) supply chain members' adoption behavior, and ii) seller intervention in the adoption process. Thus, we investigate reseller adoption of SMG solutions that are IoT-based power systems, and focus on performance expectancy and effort expectancy because they define an input-output principle for the business. Any organization’s business model can be defined as the system of transforming inputs, through its business activities, into outputs [34]. A reseller has to devote effort to understand and sell technology to the end customers (input) to achieve economic performance (output). We anticipate that the more a reseller expects to benefit from the adoption of a specific technology and the less effort it takes to learn to sell that technology, the higher the likelihood of reseller adoption. Also, we consider the likelihood of adoption through resellers’ positive attitudes and behavioral intention to adopt SMG for reselling purposes.

Performance Expectancy, Effort Expectancy and Behavioral Intention
Performance expectancy is the degree to which using a technology will provide benefits in performing activities [62]. While TAM explains performance expectancy through perceived usefulness [5], innovation diffusion theories view it as an output expectancy [61] that pertains to the anticipated relative advantage associated with a technology [14] or as the outcome expectations [9]. Numerous studies have evidenced the impact of expected benefits on technology adoption [23] [56]. SMGs, as intelligent power systems, provide a number of benefits to resellers, including improved business performance as the demand for the technology upsurges [30]. However, resellers of such complex power systems technology are dependent on the vendors’ knowledge of the projected user benefits and business opportunities that the technological development brings [44].

Effort expectancy is the degree of ease associated with the adoption of technology [62]. It predicts both outcome expectancy and adoption [61]. While TAM views effort expectancy as perceived ease of use [5] [63] diffusion theories stress the complexity of technology. Effort expectancy is traditionally studied in tandem with performance expectancy to grasp both the benefits and sacrifices associated with technology adoption. For SMG resellers, effort expectancy is linked with their need to learn these solutions and to engage in solving individual customer problems associated with the delivery and implementation of the solutions. Research on reseller adoption of cybersecurity solutions has suggested that the easier the solution is to adopt among the resellers, the less operational tasks are required in the supply chain and the smaller the expected effort is to sell the solution [44].

Previous research suggests that intention towards action is the best predictor of actual behavior [3] [38]. Behavioral intention measures the strength of an actor’s attitude to perform the target behavior, such as the adoption of technology. According to Venkatesh and colleagues [63], the relationships between the intention to accept technology and performance expectancy and effort expectancy are essential parts of technology adoption. The UTAUT also emphasized the role of facilitating conditions and social influence [62] [63]. In the mainstream technology adoption research, facilitating conditions are considered as objective factors in the environment that observers agree make an act easy or difficult to accomplish. In the next section, we investigate vendors’ intervention in terms of their innovation orientation as a facilitating factor for the reseller adoption of SMGs.

Innovation Orientation as Vendor Invention in Reseller’s SMGAdoption
Previous research [17] [45] argues that innovation orientation can explain why companies differ from each other in terms of how they compete in the market. Differences in innovation orientation lead to different outcomes and performance [24] [50]. Yet, innovation orientation is poorly understood [53] because it has been conceptualized in many ways [17] [24]. Worren and colleagues [46] view innovation orientation as a commitment to more and faster innovations. New product introductions reflect
the output that results from R&D inputs [17]. While businesses vary in terms of the input that goes into innovation activity [17], innovation orientation enhances the likelihood of developing radically new products [13]. Innovation orientation consists of an organization’s learning philosophy, strategic direction, and transfunctional beliefs, which direct the strategy and actions toward innovation-enabling competencies and processes [24]. It means that change, creativity and risk-taking are encouraged in areas where one lacks prior experience [10] [66]. Ruviu and colleagues [1] associate innovation orientation, in terms of creativity, openness, future orientation, risk taking, and proactiveness, with the ability to generate ideas and innovate continually over time.

We draw on Simpson and colleagues [50], Talke and colleagues [32], and Dhewanto and Sohal [64], and define innovation orientation as “a strategic orientation that provides a business with the capability of identifying emerging customer needs and the capability of developing and implementing technology innovations to satisfy those needs”. Innovation orientation supports the company in having more innovative ideas and in serving various market segments by producing more innovative products. It influences technology commercialization capability, which then influences technology commercialization performance [64]. In other words, innovation orientation influences marketing capabilities that affect new product performance [43]. However, we concede that innovation orientation may have both positive effects (advantages related to innovations, markets, employees, and operations) and negative effects on performance (too much change, market risk, employee attitudes, and increased costs) [50].

In sum, the hypotheses used to establish a conceptual research model and their theoretical bases are presented in Table 1.

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Theoretical basis</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1: Reseller’s intention to adopt SMGs is positively influenced by the performance expectancy of the solution as perceived by the reseller.</td>
<td>TAM [18], The degree to which a person believes that using a particular system would enhance his or her job performance [18].</td>
</tr>
<tr>
<td>H2: Reseller’s intention to adopt SMGs is positively influenced by the effort expectancy of the solution as perceived by the reseller.</td>
<td>TAM [18], The perceived ease or difficulty of performing a behavior and it is assumed to reflect past experience as well as anticipated impediments and obstacles [21].</td>
</tr>
<tr>
<td>H3: Reseller’s intention to adopt SMGs is facilitated by the vendor’s innovation orientation as perceived by the reseller.</td>
<td>UTAUT [60] suggests the role of interventions for adoption; Strategic orientation theory [16], innovation orientation enables firms to create business advantages through innovation [50].</td>
</tr>
<tr>
<td>H4: Reseller’s actual sales of SMGs positively linked with their intention to adopt the solutions.</td>
<td>Theory of planned behavior [3] [20] [38]. Individual or organizational behavior is preceded by behavioral intention.</td>
</tr>
</tbody>
</table>

**RESEARCH METHODS**

We conducted semi-structured interviews with three industry experts in Canada to explore ideas for designing a survey. In early 2015, we administered an online survey to power technology resellers in North America on their adoption of SMG technology and attitudes on vendor intervention. We analyzed the survey data to test the hypotheses and validate the proposed research model. A total of 300 contacts were derived from the LinkedIn account of an author who works in the power systems industry. We excluded 7 incomplete questionnaires out of the 107 returned (36% response rate), thus resulting in a set of 100 completed questionnaires. The majority of surveyed resellers seem to target large customers (51%) located in all geographical market areas: local (36%), national (36%), and international (39%). The data confirms that reseller adoption of SMGs is low; 48% receive less than 5 percent of their sales from SMG solutions, and only 11% consider SMG solutions as a major source of revenue.

Measurement scales were derived from prior literature. As adoption of technology by supply chain intermediaries differs from that of individual users, we adapted measures for performance expectancy (PE) from Davis [18] and Venkatesh and colleagues [63]. Measures for effort expectancy (EE) were adapted from Davis [51], Venkatesh [90], and Venkatesh and colleagues [93]. We also used the list of new product launch failures by Schneider and Hall [35], because the easier the technology is to learn for resellers, the better motivated they are to sell the technology to end-customers. Measures for vendor’s innovation orientation (IO) were derived from Dhewanto and Sohal [64]. Behavioral intention (BI) typically focuses on the direct intention to perform a task [37], but we measured the extent to which the resellers consider the SMG adoption to be a good business opportunity.

We used SmartPLS 3.0 software [29] to analyze data, test the research model, and validate the hypotheses. PLS suits for analyzing reseller adoption of SMGs because it is appropriate for predictive behavioral models such as user adoption [19] and it has been used in seminal research papers on user and technology adoption [60] [61] [62]. We used Harman’s one-factor procedure because all data came from the same survey [25] as well as respondent’s work experience (in years) as a marker variable [57]. The five factors explained 78 percent of the total variance, and the first factor explained 48 percent (KMO = 0.864, df = 210, p<0.001). No single factor explained most of the variance and there were no significant correlations between the marker variable and the latent variables, suggesting that common method bias is not a concern. As to reliability and validity tests, all item loadings were > 0.70 [60] and Composite Reliability and Cronbach’s alpha for each construct was >0.70 [39]. Average Variance Extracted for each construct was >0.50 [26], suggesting convergent validity. To assess discriminant validity, we examined the correlation matrix of the constructs (cf. Fornell and Larcker [8]) and used the heterotrait-monotrait ratio of correlations (HTMT) (cf. Henseler and colleagues [26]). All HTMT values are <0.85, suggesting that there is sufficient discriminant validity.
RESULTS

The analysis shows that hypothesis H1 was confirmed (β=0.547, t=4.918, p<0.001), but performance expectancy also has an unexpected direct positive link (β=0.209, t=2.676, p<0.01) to reseller’s sales of SMGs. H2 was not confirmed (β=0.142, t=1.130, n.s.) although we anticipated that there will be a positive relationship. However, the analysis revealed that, if there was a correlation, it would be negative, which is in contrast to the theory of technology adoption. The analysis confirms H3 (β=0.233, t=1.961, p<0.05) and H4 (β=0.383, t=4.083, p<0.001). \( R^2 \) values are acceptable as performance expectancy and innovation orientation explain 38 percent of variance in behavioral intention which, in turn, explains 15 percent of variance in reseller’s actual sales (cf. Legris and colleagues [49]). The final model and validated relationships are illustrated in Figure 1.

![Figure 1. Final model and validated relationships](image)

Finally, we examined the goodness of fit for overall model to validate the structural model. First, we calculated the global fit measure (GoF) (cf. Tenenhaus and colleagues [42]). Although this measure has been criticized in recent literature, the GoF of our model is 0.43, indicating a large effect and a good fit to the data. Second, we examined the standardized root mean square residual (SRMR) (cf. Henseler and colleagues [26]). A value of < 0.10 is considered a good fit, but a more conservative view recommends the 0.08 threshold [35]. SmartPLS reports the SRMR for both composite models and common factor models; usually, the composite model SRMR is relevant. The SRMR for our composite model was 0.074, thus suggesting a good fit of the model.

CONCLUSION

This study investigated the reseller adoption of SMGs that are intelligent power systems operating on the IoT technology. An analysis of survey data from 100 power system resellers in North America showed that resellers’ performance expectancy promotes their SMG sales both directly and indirectly through the intention to adopt and resell such solutions. The unexpected direct relationship confirms that performance expectancy is the primary driver for resellers to sell novel IoT-based power system solutions. Conversely, effort expectancy does not drive resellers to adopt SMGs. This is interesting, because prior literature on technology adoption has consistently shown the positive relationship between effort expectancy and behavioral intention [52]. In fact, the negative yet statistically insignificant value fuels speculation; do some of the resellers even prefer selling novel, complex technology, because learning and mastering such technology would give them an advantage over their competitors?

We show that reseller adoption of IoT-based power systems technology is driven by resellers’ performance expectancy instead of effort expectancy. Previous literature has stressed that effort expectancy has a dominant role in user adoption [18]. Our finding is in contrast with this notion and highlights that reseller motives to adopt new technology differ from those of users. The negative, yet statistically insignificant effort expectancy-behavioral intention relationship suggests that resellers value the effort required to learn the new technology, as easy-to-learn solutions are easy to sell, making them vulnerable to price competition. However, it remains for future research to investigate this relationship. The findings contribute to the literature of technology adoption by pinpointing the role of vendor intervention for reseller adoption. Our results extend the technology adoption theory by arguing that the vendor plays a key role in the adoption processes, while technology adoption studies commonly [18] [62] [63] address the value of technology itself, the effect of environment, previous experience, or the role of peer influence. Also, the results increase our understanding of the role of innovation orientation in organizational decision making within supply chains.

As to limitations, our strict focus on reseller adoption does not allow to investigate the adoption of the new intelligent technology across various stakeholder groups in the power systems market. Our study suggests that reseller motivations differ from those of end users, whereby user adoption theories may not work well for reseller adoption, and possibly to other stakeholders. Thus, we
call for the development of more accurate models for reseller adoption, including different motivational factors, other indicators of vendor intervention, and the influence of other stakeholder groups on reseller adoption. Finally, our study took place among power systems resellers in North America serving end users in various market areas, but previous research has indicated some differences in technology acceptance across different countries and cultural areas. Hence, it would be interesting to investigate whether such differences between cultural and geographical areas exist among supply chains in different markets.

REFERENCES


*The Fifteenth International Conference on Electronic Business, Hong Kong, December 6-10, 2015*


TECHNOLOGY ADOPTION FACTORS FOR OLDER ADULTS:
AN EXPLORATORY GERONTECHNOLOGY STUDY

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ABSTRACT
This study aims to explore the underlying factors of older adults’ technology resistance through qualitative exploratory method. A total of 139 older adults in Malaysia have been interviewed. The findings of this study shed light into these older adults’ experiences with new technology and factors affecting their technology adoption. The preliminary findings are reported and discussed.

Keywords: Gerontology, technology adoption, near field communication, quality of life, Malaysia

INTRODUCTION
Ageing is a worldwide phenomenon. The ageing population has increased in both the developed and developing countries. According to Østlund [10], the proportion of older adults over 60 year-old is projected to double from 11 percent to 22 percent between 2000 and 2050. It was also reported that 80 percent of the world's ageing population will live in developing countries by 2050 [7]. This is placing pressures on the families, government, institutions and organizations. Increasingly, urban and international migration has resulted in more people leaving the rural areas for better job opportunities. This leaves a large number of the older adults living independently in the rural areas. In addition, the family structure is changing and moving away from the traditional family structure to a situation where the older adults are having to live alone. In this situation, older adults suffer a consequence of age-related incapacity.

There is surfacing evidence, as advocated by research (e.g. [1], [2], [17]) that indicates technology holds great potential for supporting the older adults’ vitality and independence at home. Gerontology is a technology domain that integrates existing and developing technologies to the needs of both ageing and aged people, with the goal of increasing quality of life of older adults [15]. Although gerontology and assistive technology have great potential usage in ageing population, successful technology adoption is dependent on the technology acceptance behavior of older adults. In most instances, the older adults appear to be resistant to technology adoption. This notion is further supported by Marschollek et al. [9] which posit that older adults’ reluctance (behavior) is the major barrier to technology adoption. A number of factors such as age, computer-related self-efficacy, anxiety and inadequate technical experience, perceived technological complexity have been identified as reasons of older adults’ resistance to new technology [1], [5], [8], [14],[16], [17]. However, problems faced by older adults in using new technology are not confined to these cognitive factors [4]. To address this research gap, this study aims to explore the underlying factors of older adults’ technology adoption (or resistance) through qualitative exploratory method.

LITERATURE REVIEW

Technology Adoption in Older Adults
Gerontology is regarded as "an interdisciplinary field of research and application involving gerontology, the scientific study of ageing, and technology, the development and distribution of technologically based products, environments and service [3, p.331]. Within the gerontology literature, there have been many published studies on older people’s technology adoption using quantitative approach such as surveys and structural equation models [12]. While a plethora of scholarly publications (see: [6] [13] [17]) concerning technology adoption of older adults have increased over the last decade, extant studies have not provided insights into the elderly-specific factors influencing the technology adoption of older adults. Therefore, this study is framed to examine elderly-specific factors of older adults’ technology adoption (or resistance) through qualitative approach. These factors include product, person and economic aspects.

NearField Communication (NFC) Home System
In this study, we applied the NFC-enabled technology and Bluetooth-enabled Raspberry-PI to design and develop the NFC home system. The NFC home system is designed using a set-top-box as a convergence platform to integrate different home appliances for home automation. In this system, home appliances are operated using tap-to-connect mechanism where users tap an NFC card on the set-top-box to activate a specified digital appliance. The set-top-box can read multiple NFC cards for different home devices. Internet connection is not required for the entire operations. Given that this NFC home system is portable and easy-to-use, we regard the system as an assistive technology because it provides a convenient way for older adults to improve their independence at home. Many products are not tested with older people before they were classified as technologies for older adults [10]. It is likely that an older adult’s direct experience of a technology influences their evaluation of the technology. In this study,
an experiment was conducted, allowing participants to have a direct experience with the NFC home system. Interviews were then performed to understand the participants’ perception of and their experience with the technology. This is important to understand the key factors influencing technology adoption in older adults.

RESEARCH METHODOLOGY
This research obtained approval from the university’s Human Research Ethics Committee. The target sample for this study was older adults living in Malaysia. A total of 139 older adults (i.e., 65 males and 74 females) participated in the experiment, survey questionnaires and interviews. The breakdown of age group is as follows: 48 participants (between 55-64 years old), 57 participants (between 65-74 years old), 29 participants (between 75-84 years old), and 5 participants (above 85 years old). The demographic details are shown in Table 1.

Before the experiment session, the participants were briefed on the research objectives, the experimental tasks and precautions. Participation was voluntary and prior consent was obtained. All participants were assured of confidentiality of their experience and feelings during the experiment. After completing the experiment, each participant was asked to answer a questionnaire. Face-to-face interviews were then conducted. During the interview, semi-structured and open ended questions were asked, allowing the older adults to articulate their experiences and desires towards the NFC home system. After completing the interview, semi-structured and open ended questions were asked, allowing the older adults to articulate their experiences and desires towards the NFC home system. The open ended questions asked about the participants’ feelings and experience of using the home system, difficulties using the home system, their attitude towards the home systems, the role of new technology in their lives, and their attitudes towards new technology. The interview was audio-taped and then transcribed. Common insights were identified and coded in a code book. Themes and subthemes were identified from the coded data. Table 1 Participants’ Demographic

<table>
<thead>
<tr>
<th>Variables</th>
<th>Frequency</th>
<th>Percentage (100%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Females</td>
<td>74</td>
<td>53.2</td>
</tr>
<tr>
<td>Males</td>
<td>65</td>
<td>46.8</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>55-64</td>
<td>48</td>
<td>34.5</td>
</tr>
<tr>
<td>65-74</td>
<td>57</td>
<td>41.0</td>
</tr>
<tr>
<td>75-84</td>
<td>29</td>
<td>20.9</td>
</tr>
<tr>
<td>Above 85</td>
<td>5</td>
<td>3.6</td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Informal</td>
<td>12</td>
<td>8.6</td>
</tr>
<tr>
<td>Pre-primary school</td>
<td>15</td>
<td>10.8</td>
</tr>
<tr>
<td>Primary school</td>
<td>34</td>
<td>24.5</td>
</tr>
<tr>
<td>High school</td>
<td>39</td>
<td>28.0</td>
</tr>
<tr>
<td>Diploma</td>
<td>11</td>
<td>7.9</td>
</tr>
<tr>
<td>Bachelor degree/professional qualification</td>
<td>13</td>
<td>9.4</td>
</tr>
<tr>
<td>Master/PhD degree</td>
<td>15</td>
<td>10.8</td>
</tr>
</tbody>
</table>

DISCUSSIONS AND CONCLUSION
The primary goal of this study is to explore the underlying factors of older adults’ technology adoption (or resistance) through qualitative exploratory approach. The qualitative evidence underscores four meta-themes namely, product, person, economic and desired outcome/benefit (see Table 2). As shown in Figure 1, the product factors such as easy-to-use (i.e., simple and practical) and security (i.e., misplacement of peripheral devices) are main predictors of older adults’ desired outcomes (e.g., enhance quality of life, happiness, independence and convenience). This relationship is jointly influenced by person factors (i.e., fear of use and personality) and economic factor (i.e., cost). From a practical aspect, this study provides a new insight for technological manufacturers and developers to focus on the product design, particularly on simplicity, practicality and security that are desired by older adults. In addition, the industrial practitioners should look into ways to target their products/services based on different person factors and economic factor.

Table 2 Themes and Sub-themes

<table>
<thead>
<tr>
<th>No</th>
<th>Themes</th>
<th>Sub-themes</th>
<th>Selected statements by participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Product Factors</td>
<td>Easy to use</td>
<td>It’s pretty simple. All you have to do is take the card and tap it on the box and it’s done. (P1029)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Simple</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Practical</td>
<td>It is not necessary to walk towards the switch and on it and it is easy to off it as well. Overall, it is a very good appliances. (P2003)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Security</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Misplacement</td>
<td>Difficulty to me as an aged person is …maybe the lost of</td>
</tr>
</tbody>
</table>
Peripheral device (card) the card. I may misplace the card. I don’t know how many cards we need or just one card. Sometimes, we tend to forget where we put the card. That’s our challenge. (P2007)

<table>
<thead>
<tr>
<th>Person Factors</th>
<th>Fear of use</th>
</tr>
</thead>
<tbody>
<tr>
<td>o Positive</td>
<td>It’s not scary as it is not dangerous. Why would I be scared? It’s just a card and it’s convenient. Even though it’s raining heavily with thunder you won’t be afraid to get electrocuted with the card. (P1012)</td>
</tr>
<tr>
<td>o Negative</td>
<td>Yes, I’m afraid I did not touch the point (on the box) properly and light cannot be turned on/off. Just have a thought about it and worry at the same time. (P1019)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Personality</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>o Passive</td>
<td>If you teach me and I understand, then I will use it. If you don’t teach me then I can’t use it. (P1004)</td>
</tr>
<tr>
<td>o Active</td>
<td>If everyone is using it you must adapt to the current flow of society. Whichever is more convenient and most suitable then I would use. (P1029)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Economic Factor</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>The only thing you worry is for senior citizen that it’s very costly. The cost to acquire one. That is the b-b-big question mark. (P2006)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Desired Outcome/Benefit</th>
<th>Enhance quality of life</th>
</tr>
</thead>
<tbody>
<tr>
<td>o Happiness</td>
<td>Sure, it can help me to become happier. (P1001)</td>
</tr>
<tr>
<td>o Independence</td>
<td>Ah… it will help most of the people to live a better life… Like older people, they don’t like walking distance to on the switch. They want them to be near them, so that when they touch it the light is on. They don’t have to walk to “on” the light. (P1014)</td>
</tr>
<tr>
<td>o Convenience</td>
<td>Convenient and easy la… What should I say? Ah… Like in the hotel they use cards to open the door, easy, you don’t have to search for the keys. For example, you don’t have to search for which switch to on the light you want. Here you have the card ready, when you tap it on, it’s open. (P1014)</td>
</tr>
</tbody>
</table>
REFERENCES


THE ACTIVE AND INTERACTIVE THINKING LEARNING RESEARCH IN "FLIP EDUCATION"

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ABSTRACT

In 2014 a total of 183 schools and 40 high schools participating in the experiment, the schools are in the Tablet PC as a learning tool, application-oriented learning and teaching strategies topics flipped learning, so that students in the teacher's guide concept after active exploration program, in peer under the cooperative learning deepen CBC. After the rise of the majority of primary and secondary schools flipped classroom teacher began groping flip-teaching philosophy, the domestic schools have been put into digital teaching become common trend, there is a period of systematic research in schools to promote the use of the Internet and action vehicles, auxiliary in teaching of information technology equipment, emphasizes active learning, enhance learning interaction between teachers and learners understand and factors influencing teaching effectiveness, so with this initiative (active) and interactive (interactive) flip teaching experiment program.

Keywords: Flip Teaching ・ Interactive Learning ・ High Order Thinking Skills

INTRODUCTION

The GDP declined over the past fifteen years, due to uncreative students unable to increased domestic production value while these students cast into the community. Now the competition is not in factories but in schools, this driving the educational innovation in teaching strategies, nurturing talent education need to be adjusted. The current educational reform trends including:(1) stimulate active learning, (2) encourage cooperative learning,(3) provide personalized learning environment,(4) effective learning, (5) fair learning. Education reform is urgent imperative in Taiwan to meet global challenges.

The flip classroom growing up, teachers of primary and secondary schools began groping flip-education philosophy, they make the past teaching described into video and recording into the clouds, so that students do preview or review before or after school, such become mainstream teaching, mainly current high school and college application system not completely removed, exam still remain in the Bloom teaching, cognitive learning, students can cope alone memory test, but after the course easily forget. Digital teaching become common trend, for research the effectiveness and impact of teaching factor, hence make an active and interactive flip education experiment program.

This project will provide a source of knowledge teaching in the digital cloud environment to stimulate motivation for active learning, via two schools as an experimental field of teaching, curriculum materials including primary and secondary schools to complete an experimental study.

LITERATURE REVIEW

Flip Education

Gerstein (2011) considered that can be independent learning in flip teaching, e-learning, watching movies is just one option only, game simulation and interactive learning site (or Apps) resources, are possible options, the whole learning experience all made by teachers.

The implementation of "flip education ' ,is to transition from knowledge receiver to an active learners , because information transfer (lecture) is only the most basic level of learning activities.

In the "flip teaching" situation, Benjamin Bloom's cognitive teaching objectives viewpoint, the lower levels of "memory" and "understanding" ability is accomplished via independent learning, and "application", "analysis", and " evaluation "and" creating" the higher levels boot by the classroom teacher and cooperative learning to interact with their peers ; in other words, in the traditional teaching, students extremely difficult to develop the" evaluation "and "creating" higher levels cognitive abilities, but now may have more opportunity in "flip teaching ' to change traditional teaching methods, by " interactive "situations and other guidance .

Digital Learning Theory

Enhance environmental incentives behaviorism

The behaviorist proposed through activities to for student learning, which allows students to change behavior from observation. Learning is through repeated stimulation and feedback. That often used in the field of computer-aided learning rendering stimulus, and the student find solutions to solve the problem as response, by means of the system provides feedback to reinforce learning.
Student learning progress be given to the results of stimulus and response, learning environment more recognize and exploration than active learning. Internet provided e-learning environment in depth connotation, to stimulate behaviorism, the reaction theory, and observe the reaction of the students' learning, and record learning outcomes.

**Digital learning Scope**

For several years domestic schools promote e-learning platform, the effectiveness is being questioned, the main reason is that digital learning platform mere formality only can download materials, watching the syllabus, homework sumit and other functions. Which lack of situational exercises to learn from each other, and problems solution limited to train students from contextual learning, for the students to learn through the cloud computing environment, teachers need to put up scaffolding guide the initial build environment. Because the student knowledge is insufficient. This is in line with constructivist advocated, through the Arrangement student knowledge to construct new concepts.

Most constructivist (Bischoff & Anderson, 1998; Novak & Gowin, 1984) believes that prior knowledge is the follow-up related concepts in learning. Therefore, the study architecture in accordance with the theory of constructivism, provide students cloud computing environment, a community learning platform scaffolding, and experiential learning situation, coupled with student collaborative learning, can enhance the ability of independent study and application of knowledge and so on.

**Active learning: effective learning ability**

"Active learning" emphasizes the "analytical thinking" importance. Study should marked by " people own mind," according to the mark been done in order to recall. How to mark in the mind as a sign? Through homework analysis, students set question and process of answer by familiar knowledge, that is " known absorb an unknown." This "question and answer" is an integral part of the learning process, the most important key. Students start the correct reading and get major concepts for himself the right notes

"Active learning" is the "hourglass learning." When students systematic analysis and compress information, to find the essence of the data, the key lessons, grasp out the key points, naturally impressed by lots of information the compress and release process, place homework in long-term memory, through these tips in exams, recall the relevant homework, such a better learning. Hourglass active learning is to teach students to organize their own learning priorities, smoothly absorb knowledge.

**High-level thinking**

High-level thinking or complex-level thinking, the corresponding is Basic-level thinking. Prior to learn complex cognitive skills, shall learn simpler cognitive skills; therefore the effective application of high-level thinking must be based on the basic level thinking. The basic-level thinking including memory, recall, basic comprehension and observation skill. The high-level (complexity level) thinking involves multiple possible answers and participants judgment. Udall and Daniel (1991) consider that the high-level thinking includes three way thinking: judgmental thinking, creating thinking and problem solving.

Thus, high-level thinking involves a series of proactive process to a judgment making, decision making, problem solving, to construct and communicate ability and willingness. In these psychological process, thinking the situation appropriately, selecting, combining and applying its related knowledge and skills, and to monitor and adjust their thinking at times.

Figure 1 shows constructivist learning with high-level thinking skills learning.

![Figure 1. Constructivism in Broom cognitive learning classification](image-url)
Teaching Quality Assessment

DeLone and McLean (1992) proposed that system quality and information quality will affect the use of information systems and user satisfaction, and above both will be affected individual impact, and further occur organizational impact.

Although DeLone and McLean (2003, 2004) pointed out that the quality of the three information systems: information quality, system quality and service quality as the intent of using the antecedents, but some other scholars, such as: Jeong and Lambert (2001) combine this three factors into a single facet, to explore the connection between behavior and its intention, therefore factor analysis to confirm the discriminant validity convergent validity between the three factors, to learn more about the quality of the facets of information systems, that will be relatively substantive approach.

Teaching quality result can be obtained from information system success model, successful model will include three independent variables and a dependent variable, the three independent variable is the quality of teaching-learning, which depends: information quality, system quality and service quality, and the reaction to the teaching quality can be analyzed as follows:

System Quality (hardware platforms): Internet service, platform, vehicles.

Information quality (teaching software): curriculum, teaching materials, screen design, interactive mode.

Service Quality (teaching activities): teaching strategies, curriculum, tests, exercises, assignments, etc.

The digital teaching applications of cloud computing services

Digital teaching can be divided into two levels, "teach" and "learn": (1) "Teaching", teacher-centered, use E of equipment for teaching; (2) "Learning" is a student-centered learning allow students to use the Internet learning.

"Digital teaching” is basically using the Internet and information equipment, such as the Internet, computers, digital lectern, projectors, interactive whiteboards, teaching network cameras, etc., the Internet as a medium, delivery teaching digits material to the distal end learners. Its feature is the use of Internet as the main medium of instruction, learners and professors who are available in different time, space., asynchronous communication mechanism to reach a learning network through two-way synchronization, the main advantage is that without the barriers of space limit, can be anywhere, anytime learning and interactive learning unlimited number of teaching materials can be reused, and can record the learner’s learning process via the learning system (Wen & Chen, 2011).

Highly interactive teaching methods

Another industry-university research project plans by the host of this case, the development of highly interactive synchronous teaching system can also be described in this era of science and technology information explosion, people learn through the use of diverse media and different learning styles, with the advent of carrier operations, 3G unlimited internet popularity, the promotion of paperless concept, various service applications, establish ubiquitous personal learning environment, anywhere learning, not necessary to be tied in front of the computer, not limited to the classroom. Learners can pre-loaded in their vehicles, the application increasing its elasticity. This system meets student career development, self-study purpose of action in response to the trend of which is shown in Figure 2 illustrates the use of design.

Figure 2. The Educational Technology operation mode

Teaching and learning highly integrate interactive application mode

Demand of teaching is unlimited, creative imagination is infinite, classroom teachers and learning system development direction and concepts illustrated as follows:

(1) Interactive Teaching System simulcast Construction
(2) Provide a variety of operating modes and auxiliary teaching tool
(3) Provide classroom Measure assessment mechanism
(4) Instant Watch Results
(5) The learning feedback course

RESEARCH METHODS

In this study, to built up a cloud “Teaching” and “Learning” environmental operations, divided into Moodle LMS teachers teaching platform for students to share with the course of study data collection, and students interactive Google autonomy learning platform. Teachers disseminate knowledge, design materials and planning teaching activities. Students learn to communicate as interactive learning platform, through teaching and research planning, implementation and evaluation of the three phases, and construct network learning behavior theoretical model to know the learning effect, and other factors.

Selected Learning Courses
Study flip courses Learning Behavior in selected primary and secondary schools students of all grades, grouped with the school e-learning platform and cloud computing environment as the main learning platforms, by learning behavior analysis and comparison between platforms, influence factors and learning outcomes between the two.

Cloud Service Operations mobile devices
Cloud computing environment in addition to e-learning platform in the fixed desktop computers connect to the Internet but also stressed that action learning omnipresent, and action learning environment with small, light, wireless transmission, handwriting input, portability and other features for indoors, outdoors individual or group work and other learning situations, so learning extends beyond the classroom and can provide face to face interaction (Oloruntoba, 2006), using action learning vehicle is based tablet PC, desktop supplement.

Cloud computing platform e-learning environment
The project is divided into Moodle teachers teaching platform (Figure 3) and student self-learning platform Google. Teachers to share and disseminate knowledge, use platform design materials and planning teaching activities. Cloud computing environment will use Google's cloud platform to build a new Google cloud computing platform for learning environment (Fig4).

Figure 3. Teachers teaching platform Moodle

Figure 4. Flip Learning System Architecture
Establish Student learning behavior research framework
This project research framework shown in Figure 5, the contents of each variables as follows: (1) external variables as "environmental" and "teaching material" (2) E-learning motivation affected by external variables, "thereby affecting the" learning effects "and" satisfaction. (3) external variables as factors affecting the motivation of the Internet courses, through literature analysis, there are "practicality", "effectiveness" and other two variables.

System Assessment procedures
The first year of the project plan to build up cloud computing platform E-learning environment prototype, arrange three classes total 150 secondary school students, for a period of 12 weeks of experimental teaching and questionnaire respondents, each class divided into 10 groups, each group has at least three tablet PCs, the assessment procedures as follow: (1) teachers participate in the program should attend at least 18 hours flipping teaching strategies. (2) students and teachers involved in the apply cloud account and explain the procedure. (3) Student groups practice connect the cloud and set their own collaborative learning platform and share with same group of students and teachers. (4) The three teachers were weekly design teaching content and discuss issues related online learning materials to the students' in general E-learning platform and cloud computing platform. (5) The groups discuss in collaboration to answer questions, the mobile devices and Cloud Connect allow teachers to use cooperative learning dialogue text, interventional and guidance. (6) The teachers collaborate weekly observation and assessment of student learning.

THE RESEARCH RESULTS AND DISCUSSION
4-1. Student motivation and environmental facilities vs teaching materials have significant correlation
Learning motivation and environment facilities, teaching materials related tables

<table>
<thead>
<tr>
<th></th>
<th>Learning motivation</th>
<th>environment facilities</th>
<th>teaching materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson related</td>
<td>Learning motivation</td>
<td>1.000</td>
<td>.755</td>
</tr>
<tr>
<td></td>
<td>environment facilities</td>
<td>.755</td>
<td>1.000</td>
</tr>
<tr>
<td></td>
<td>teaching materials</td>
<td>.795</td>
<td>.788</td>
</tr>
<tr>
<td>Distinctiveness (one-tailed)</td>
<td>Learning motivation</td>
<td>.000</td>
<td>.000</td>
</tr>
<tr>
<td></td>
<td>environment facilities</td>
<td>.000</td>
<td>.000</td>
</tr>
<tr>
<td></td>
<td>teaching materials</td>
<td>.000</td>
<td>.000</td>
</tr>
<tr>
<td>number</td>
<td>Learning motivation</td>
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<td>542</td>
</tr>
<tr>
<td></td>
<td>environment facilities</td>
<td>542</td>
<td>542</td>
</tr>
<tr>
<td></td>
<td>teaching materials</td>
<td>542</td>
<td>542</td>
</tr>
</tbody>
</table>

From above table, after three experimental schools through digit environmental facilities, teaching materials design. Conducted a few weeks digits teaching, learning motivation of students from high interactive e-learning platform is significantly elevated.

4-2. student learning outcomes effectiveness, practicability significant correlation
Learning outcomes effectiveness and practicability related tables

<table>
<thead>
<tr>
<th>Control variable</th>
<th>related effectiveness</th>
<th>practicability</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.000</td>
<td>.389</td>
</tr>
<tr>
<td>practicability</td>
<td>Significant resistance (two-tailed)</td>
<td>.000</td>
</tr>
<tr>
<td>df</td>
<td>539</td>
<td>0</td>
</tr>
<tr>
<td>practicability</td>
<td>Significant resistance (two-tailed)</td>
<td>.000</td>
</tr>
<tr>
<td>df</td>
<td>539</td>
<td>0</td>
</tr>
</tbody>
</table>

From above table, affect students' learning motivation two outer factor "practicality", "effectiveness", under high interactive learning platform and digital interactive teaching in the three experimental schools, learning satisfaction is highly significant Related.
4.3. Learning satisfaction and effectiveness, practicability related tables

<table>
<thead>
<tr>
<th>Control</th>
<th>variable</th>
<th>effectiveness related</th>
<th>practicability related</th>
</tr>
</thead>
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<tr>
<td></td>
<td></td>
<td>1.000</td>
<td>.347</td>
</tr>
<tr>
<td></td>
<td>effectiveness</td>
<td>Significant resistance (two-tailed)</td>
<td>.000</td>
</tr>
<tr>
<td></td>
<td>df</td>
<td>0</td>
<td>539</td>
</tr>
<tr>
<td></td>
<td>practicability</td>
<td>Significant resistance (two-tailed)</td>
<td>.000</td>
</tr>
<tr>
<td></td>
<td>df</td>
<td>539</td>
<td>0</td>
</tr>
</tbody>
</table>

From above table, affect students' learning motivation two outer factor "practicability", "effectiveness", under highly interactive learning platform and digital interactive teaching in the three experimental schools, learning outcomes are highly significant correlation.

Construction flip education of digital teaching mode

Cloud computing processing mode greatly reduce the cost of educational information system construction. Cloud provides a suitable environment for school teaching data center, network center, and other related tasks. Through the IT infrastructure provided by cloud computing, not only reduce the investment to purchase hardware devices, frequent maintenance and upgrade costs; to develop grid computing mode and better management mechanism, high level of automation, network virtualization will achieve the maximization of resource sharing and collaborative environments. Flip education is bound to become an important teaching strategies.

(1) Increase the teaching digitized materials, amplified resource content.
(2) Find out the students E-learning behavior.
(3) Provide students analyze the digital learning behavior curve.
(4) Understand Flip education effectiveness in situations.
(5) Training Teachers digital teaching materials editing skills.

CONCLUSION

Recently, the Internet web 2.0 accompanied by a large number of Internet multimedia data, and now most of the campus e-learning platform architecture, are based on a single computer or server to set up the basis of considerations, once the overload or lack of space, should upgrade hardware and software, is a funding burden. In addition, the conventional E-learning platform is package system not flexible, students are condescend to system functions, learning depressed. In the future it might offer different courses Community E-learning materials and curriculum, as a growing number of learners join this architecture, bringing more learning service resources, such as: interactive learning modules, virtual reality-based learning modules, individuals course modules, etc., this platform use environmental resources cloud, build individual learning entrance with Community mechanism in this study, students can solo Integration into learning portfolio into individual learning entrance, everyone is knowledge creation node, can learn and grow from each other in the learning community.

REFERENCES

Brisbane, Australia.


THE APPLICATION OF THE IOT FOR MINIMIZING CONSUMPTION IN SMART HOME
Qiu-Ling Yao, NanFang College of Sun Yat-Sen University, China
LongFei Chen, NanFang College of Sun Yat-Sen University, China, y2kmorg@qq.com
Liu-Ting Wu, NanFang College of Sun Yat-Sen University, China

ABSTRACT
Excessive consumption leads to 7 trends of crises, including destruction of the atmosphere, energy crisis, social decline and conflicts. Over consumption also deteriorates human health. To reduce excessive consumption not only can improve health, it can also secure home safety and less energy consumption. The reducing over consumption can benefit human health and environmental protection. This motivates us to devise an innovative smart home App (SHA). After a survey to potential users, it reveals that the new features can help reduce the excessive consumption and deterioration of the human health as well as the transportation, healthcare and destruction of earth environment. Enterprises can also achieve their social responsibility through the implementation and popularization of the SHA as soon as possible.

Keywords: electronic commerce, IOT, smart home, bracelet, Consumption, Health, Remote control appliances

INTRODUCTION
There is an excessive consumption which leads to 7 trends of crises, including destruction of the atmosphere, energy crisis, social decline and conflicts [1]. Over consumption also deteriorates human health. To reduce deteriorated health due to excessive consumption, smart bracelet has become a hot topic; more and more people focus on healthy diet habit.

Research on how mobility and social connectivity combine to produce new knowledge, business practices, and social implications is likely to become the fourth era of m-commerce in the near future [3]. One of the significant developments in wireless sensor networks (WSN)-based smart homes is the injection of IOTs (the internet of things). The ubiquitous connectivity and distributed intelligence of the IOTs with wireless sensing technology are becoming the center point of upbeat remote monitoring and control. However, safety against gas and fire and health due to food consumption, exercise and sleep are few discussed in general motivations. This motivates us to study the related social demand.

In reality, people are easy to purchase things that they do not need because little understanding of their needs. It leads to overconsumption and related health deterioration. That is a good opportunity to do a survey of potential users of SHA and devise a new one to satisfy possible need. To have an understanding of the market on the demand of SHA and its effect on our designed SHA, it motivated this study. Besides, we want to study if we can be inspired from related IOT smart product and study the adherence of users to our SHA.

LITERATURE REVIEW
Digitization, networking and information is the era characteristic of the 21st century, with the rapid increase of mobile users e-commerce is irresistible momentum worldwide popularity and development, it provides the global trade environment, greatly improve the speed of communication, save the link of the management costs, and reduce the enterprise cost. Under this background, the companies are better to find effective methods to meet the need of market through-e-commerce.

Some surveys show that expectations of accuracy, security, network speed, user-friendliness, user involvement and convenience were the most important quality attributes underlying perceived usefulness. Regression discovered that willingness to use depended significantly on the first five factors, allowing the inter-dependencies or marginal rates of substitution between them to be estimated. Some results draw attention to demand-side changes in explaining the recent slowdown in Internet applications, like e-retail banking, and may also be useful for development planning and marketing [4][5].

Nowadays, healthy problems become more and more serious. Thus, how to keep fit is a hot topic in the world. In 1987, John Robbins published Diet for a New America, which was an early version of the book started for food revolution. He continued to work tirelessly to promote conscious food choices more than 20 years. To be a vegan can not only help reduce consumption in grains by livestock, it can alleviate the trends of crises like diminishing land, diminishing water, water pollution, green gas effect, deforestation, biological extinction, and so on. The social impact to the application of IOT and its related App is little studied. It motivated us to expand the study of smart home to safety and food consumption.

RESEARCH METHOD
Research Method
The data formed the two charts of Table 2of Appendix are from the National Bureau of Statistics of the People's Republic of China. It is about the proportion of the total population of heart disease in the country. Over the past five years, the survey data from city shows that heart disease has become the leading cause of death, especially in women. In research, users valued two things most: notification, especially in connection with high mobility; and support for simple activities like tracking [2]. It is...
expected that people like smart products with notification and tracking for health status, exercise and sleep.

Thus, it motivated us to innovate a new product-SW which can effectively prevent heart disease through getting people’s heart rate, heart rhythm, blood pressure, sleep time and analyzing the data from the users.

Heart rate is the number of beats per minute in a quiet state of a normal person. It also called quiet heart rate which is generally beats 60 to 100 times per minute.

Studies have found that heart rate can reflect a lot of health information, including: The length of life, the risk of heart disease, indicating the prognosis of heart disease, tips exercise fitness, to guess whether the work is too hard.

Adequate sleep, balanced diet and appropriate exercise are recognized by the international community as three health standards. Thus, the function of the SW is essential to detect the sleep.

With the help of the IOT network, the network can collect and analyze the data of the users without revealing the user's privacy, and carry out the tracking analysis, which will help scientists to better collect data and draw useful and reliable information for scientific research, for the benefit of human health.

Around us, there are a lot of people have little or no hospital physical examination because of certain objective or subjective reasons, the SW can help us to better observe their health, prevent diseases in a timely manner. This is a stylish and healthy product which can prevent heart disease and another disease.

**Designed Features**
Specific functions are as follows: Solar charging: light, heat and electricity conversion method is using energy from solar radiation or people's movement to generate current.

Recording sleeping quality, intelligent alarm clock function, emergency phone: The watch is a great invention which can reduce mortality effectively.

**Questionnaire**
Questionnaire survey is the most extensive and most popular method for field data collection, which is feasible and effective, and has advantages of low cost and short time. In order to be able to effectively verify the hypothesis of the study, this study followed the general principles and methods of empirical research, using the questionnaire survey method to test the theoretical construction.

With the questionnaires finished by the masses who were investigated, we can get the latest information. The questionnaire contains many aspects, including the understanding of the App, the acceptable menu of the App, the necessity of making diet according to individual healthy situation, the reason they accept vegetarian diet can alleviate the destruction of earth’s environment, with SHA how attitudes do people change, as well.

**RESULTS**

**Data Collection**
This study used a questionnaire survey to collect data. Because of the limit of time and energy, a sample survey is conducted.

The research is to study the development prospect of SHA, using online survey to get the data mostly among the young people in China.

To prevent the sense of tension and familiarity is brought to them, and ensure the accuracy of the data through the online survey, there is no limitation of time for answering.

**Sample Description**
A total of 160 questionnaires are distributed, and 160 questionnaires are collected. The specific contents can be found from the following tables.

| Table 1. A formal investigation of the personal information of the sample |
|----------------------|-----------------|----------------|----------------|----------------|
| Variable             | Sort            | Frequency | Percent (%) | Cumulative percent (%) |
| Gender               | Male            | 66        | 41.25%      | 41.25%          |
|                      | Female          | 94        | 58.75%      | 100%            |
|                      | Under 18        | 1         | 0.63%       | 0.63%           |
|                      | 18-25           | 33        | 20.63%      | 21.25%          |
|                      | 26-35           | 106       | 66.25%      | 87.5%           |

The Fifteenth International Conference on Electronic Business, Hong Kong, December 6-10, 2015
There are 66 males and 41.25% females in the sample, and 94 in 58.75%. Most of the subjects are aged from 26 to 35 years, with a total of 106. The sample is generally from office workers, to reflect the problem of their own views.

The answers for questions are as follows: all surveyed participants have ever used App; 72.5% of the participants will follow the suggested alarm to exercise; 63.8% of those will follow the suggested alarm to sleep according to individual sleep status; 76.9% of those think the reported status of individual health is helpful; 76.25% and 75% of those think the SHA is helpful in giving alarms to fire and gas in use. 93.8% of those think it is necessary to eat following a recipe according to personal health status; 88% of those think to be a vegan can save a lot of healthcare resources; 75.63% of those think to be a vegan can transfer grain from livestock to hungers to save more people. It reveals people care safety than less energy consumption. It is also interesting that people care exercise more than sleep toward a good health.

**CONCLUSION**

With the rapid IoT development, smart home is a hot topic. So an App based on users’ individual health situation in smart home is feasible. This article is mainly to discuss the development prospect of SHA. The following is the conclusion of the paper.

First, there is a good potential growth for the SHA users among available smart phone users. Second, since there is few available App support functions like the SHA and especially most surveyed users think the alarms to exercise, sleep and health status are helpful, it shows there is urgent need for SHA.

**Social Implication**

Economy, environment and community are three respects for an enterprise’s social responsibility. Since the popularization of SHA, less food and energy can be achieved with accompanying less environmental destruction, improved community welfare, and the enterprise’s social image. Enterprises can also achieve their social responsibility through the implementation and popularization of the SHA.

**Limitation of this paper**

This article adopts a research method of statistical survey, only one-way study rather than from several aspects about all possibilities of SHA. In the meanwhile, object is mainly to one than other professional or age groups without more layers and data. If students live in dormitories than homes without their own kitchens, they may not adapt SHA’s suggestion so much to cook for themselves. Thus, alternative survey on a different career can help reduce the bias. Furthermore, poor medical adherence from lower memory or mental disorder is not included in this study.

To reduce unnecessary food and energy consumption and provide adequate protection for human health as well as less home and environment can be achieved if this innovative human technology can be implemented and popularized as soon as possible.

**REFERENCES**


Appendix

Table 2.

The number of the Chinese died from heart disease which accounts for the total quantity of dead people

<table>
<thead>
<tr>
<th>Year</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
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</thead>
<tbody>
<tr>
<td>Men</td>
<td>20.77</td>
<td>20.88</td>
<td>21.3</td>
<td>21.45</td>
<td>21.6</td>
</tr>
</tbody>
</table>
THE EFFECT OF PERCEIVED TRANSPARENCY, PERCEIVED REPUTATION AND PERCEIVED SECURITY ON CONSUMER TRUST AND PURCHASE INTENTION

Zhou Feng, Shandong Institute of Commerce and Technology, Ji’Nan, China, zhoufengkey@163.com

ABSTRACT

Transparency, seller’s reputation and website security are considered to be important factors of the website that influence customer purchasing decisions in Internet shopping in China. This paper empirically examines the relative influence they have on online purchasing decisions for customers. We perform structural equation analysis with a sample of 306 observations. The results of this study revealed that perceived security and perceived reputation are critical factors affecting consumer trust, perceived transparency is the factor most closely associated with purchase intention. These findings suggest that perceived transparency plays a significant role in increasing consumer’s purchase intention. The knowledge of their relative impacts in their relative roles over customer transaction experience is useful in developing customized sales strategies. The results of this study revealed that perceived transparency exerted a stronger effect than perceived reputation on purchase intentions for customers of an online store.

Keywords: Perceived transparency, perceived reputation, perceived security, customer trust, purchase intention.

INTRODUCTION

The Internet have brought markets closer to the higher level state of perfect information in China, by reducing the information asymmetries between sellers and consumers. For consumers to make a purchase decision, it is a lot easier to search online for product alternatives, prices, product performance, and vendors. However, Taobao’s venders find that it more difficulty to convert potential customer’s purchase motivation into reality. Because of the physical and temporal distance between consumers and sellers, Internet shopping incurs uncertainty and increases risk through the information asymmetry between the two parties. How to retain existing customers to make purchases becomes a more important concern for online sellers than ever before [15].

In the presence of such risk and uncertainty, lack of trust has been identified as one of the greatest barriers prohibit Internet transactions [26]. Many studies have argued that trust in an online store has become a key predictor of customer decisions in Internet shopping [14].

Actually, previous research has proposed many trust factors, for example, emphasizing transparency clearly to online consumers can influence users’ cognition and directly facilitate the shopping goal attainment [1]. Seller reputation is also a strong factor influencing returning customers’ trust [13], the lack of security as perceived by online consumers is another of the main obstacles to the development of e-commerce [16]. However, researchers have failed to integrate all these factors into a comprehensive model, the synergy effect of these factors on online purchase decision needs more attention.

Based on the research needs outlined above, this research attempts to address these limitations by aiming to examine the relative influence of essential elements of www.taobao.com—perceived transparency (i.e., perception the level of availability and accessibility of e-market information from an Internet seller), perceived reputation (refers to the consumer’s belief that the seller’s word of mouth, or e-service provider, or brand has a good public image) and the perceived security (i.e., reflects regarding the reliability of the payment methods used) have on online consumer trust as well as purchasing decisions. Specifically, we seek to answer two research questions: (1) What are the key dimensions of online trust on www.taobao.com? (3) How would perceived transparency, perceived reputation and perceived security affect online purchase intention differently for customers at an Internet store?

This paper is organized as follows. The next section presents the literature review, followed by the research model and hypotheses. We then describe the research methodology. After interpreting the empirical results, we discuss the theoretical and practical implications and conclude with a summary.

This study contributes to our knowledge on customer decisions in a number of ways. First, it examines the relative importance of perceived transparency, perceived reputation and perceived security when customers make purchase decisions with an Internet seller. Second, while prior research has examined the effect of elements of website on online customer shopping, perceived transparency, which has been largely neglected in the literature, our results indicate that perceived transparency indeed plays an important impact on online customer purchase intention in China.

LITERATURE REVIEW

Internet shopping is characterized by risk and uncertainty for customers. Therefore, theories that explain human behavior under conditions of risk and uncertainty can shed light on customer behavior in the context of Internet shopping. With the objective of investigating the effect of perceived transparency, perceived reputation and perceived security on consumer trust, we review the theory of reasoned action [16] and the prospect theory [8].
The theory of reasoned action (TRA) [16] explains the relationship between attitudes, intentions and behaviors. TRA model posits that human beings make rational decisions based on the information available to them, and the best determinant of a person's behavior is intent which is the cognitive representation of readiness to perform a given behavior [18]. Accordingly, information quality provided by the e-commerce website contents can greatly affect the intention to purchase. Also, if the information provided by the website is reliable and accurate, then this will increase online customer trust which will lead the customer to make the initial purchase.

Prospect theory explains human decisions under conditions of risk and uncertainty from a value maximization perspective [1]. This theory suggests that people put more weight on positive outcomes that are considered certain than positive outcomes that are deemed probable. It is this certainty effect that causes people to be risk-averse when making decisions involving gains, and this effect explains why people tend to prefer an option with certain but lower benefit over an option with uncertain but higher benefit.

Trust appears in risky and vulnerable decisions and favours the reduction of perceived risk in the decision-making process, and it has been traditionally considered as a key element for the acquisition of a long-term, stable and profitable relationship [19]. Consequently, trust has become a strategic objective for a good many players in e-commerce, since the level of consumer trust is directly related to an individual’s intention to purchase [10] and, more specifically, with the degree of commitment shown by the purchaser [20].

**Perceived Transparency**

Transparency is clearly visible for online consumers, as it conveys the values of product attributes and the relationships among the product attributes, merchandising information that can influence users’ cognition and directly facilitate the shopping goal attainment [12]. Perceived transparency is perception the level of availability and accessibility of e-market information to its participants [27]. Perceived transparency benefit consumers because they are able to better discern the product that best fits their needs at a better price. On the other hand, the Internet provides sellers with flexibility to strategically determine the information they will provide to consumers via their selling mechanism.

**Perceived Reputation**

According to Wang and Vassileva [15] reputation is a subjective assessment of a characteristic or attribute one entity ascribes to another based on observations or past experiences. As an intangible asset, reputation signals information about a firm’s quality and performance [6]. Buyers want to perform transactions without revealing details about their privacy or other details, while typically need to know the reputation of the seller they intend to buy from. Reputation is nothing but a combination of the opinions of other people who have had experience with the particular seller. A seller’s reputation is a big concern for buyers prior to placing an order or making a payment.

**Perceived Security**

The lack of security as perceived by online consumers is another of the main obstacles to the development of e-commerce [3]. The reason for this is the possibility that financial data might be intercepted and put to fraudulent use [16]. Kolsaker and Payne [1] maintain that security reflects perceptions regarding the reliability of the payment methods used and the mechanisms of data transmission and storage. Perceived security may be defined as the subjective probability with which consumers believe that their personal information (private and monetary) will not be viewed, stored, and manipulated during transit and storage by inappropriate parties in a manner consistent with their confident expectations. Websites may increase consumer trust by decreasing perceived environmental risk or by raising security [3].

**RESEARCH MODEL AND HYPOTHESES DEVELOPMENT**

In this section, we develop a research model, thus, our prime focus is to investigate the relationships between consumer trust, perceived transparency, perceived reputation, perceived security and purchase intention. The conceptual model guiding this research is depicted in Figure 1. The hypotheses are discussed in detail below.

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**Figure 1. Research Model**

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Zhou
Consumer trust in e-commerce is a psychological state for consumer’s intention to purchase online. Trusting intentions, that is, intention to engage in trust-related behaviors with the Internet seller. This is not uncommon in TRA-based studies of technology acceptance (e.g., [8],[18]). Prior research has confirmed a strong correlation between behavioral intentions and actual behavior [31]. Based on the above discussion, if the information provided by the website is transparency, reliable and accurate, along with marketer’s reputation, then this will increase online customer trust which will lead the customer to make the initial purchase. Thus, it can be hypothesized that:

**H1. Consumer trust in an Internet shopping context has a positive effect on purchase intention.**

Perceived transparency refers to the perception extent to which information is made available to market participants, including pricing, product, and supplier information [29]. Market transparency is negatively affected by sellers’ decisions to bias, conceal, or distort information. A biased market is defined as a market where product and price information from all sellers is not presented equitably. A market that displays only prices but lacks information about product characteristics is not fully transparent because information is incomplete. On the other hand, a market that distorts information is not fully transparent because the information is inaccurate. Incomplete or distorted information may be driven by a seller’s intentional market designs, or by technological imperatives that limit the quality and quantity of information that can be made available. Perceived transparency may also have a direct effect on purchase intention, as previous research (e.g., [12],[14]) has reported. In the context of Internet shopping, these relationships are likely to apply to both potential and repeat customers. Hence, we hypothesize:

**H2. Perceived transparency in an Internet seller has a positive effect on purchase intention.**

**H3. Perceived transparency in an Internet seller has a positive effect on consumer trust.**

Flavia’n and Guinalý’u [24] demonstrated that trust in the Internet is particularly influenced by the security perceived by consumers regarding the handling of their private data. Websites may increase consumer trust by decreasing perceived environmental risk or by raising security [3]. In the context of Internet shopping, these relationships are likely to apply to both potential and repeat customers. Hence, we hypothesize:

**H4. Perceived security in an Internet shopping context has a positive effect on consumer trust.**

Artz and Gil [18] point out that seller’s reputation is an assessment based on the history of interactions with or observations of an entity, either directly with the evaluator (personal experience) or as reported by others (recommendations or third party verification). Good reputation can create trust in e-commerce and increase consumers’ beliefs about seller competence, benevolence, and integrity [28]. Kim et al. ([8]) found that seller reputation positively affected trust in online shopping. Potential consumers or repurchases consumers need to expect that seller will have a good reputation. Seller reputation should be increase consumer willingness to purchase online from the Internet sellers. Hence, we hypothesize:

**H5. Perceived reputation has a positive effect on consumer trust.**

**H6. Perceived reputation has a positive effect on purchase intention.**
TABLE 1. Structure Measurement

<table>
<thead>
<tr>
<th>Constructs</th>
<th>Item</th>
<th>Wording</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived Transparency (PT)</td>
<td>PT1</td>
<td>It is easy to search product information from this website</td>
<td>Zhu, 2004</td>
</tr>
<tr>
<td></td>
<td>PT2</td>
<td>In this website everything is in high transparency</td>
<td>Granados et al., 2005</td>
</tr>
<tr>
<td></td>
<td>PT3</td>
<td>Information was introduced in detail</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PT4</td>
<td>The seller does not concealed product information</td>
<td></td>
</tr>
<tr>
<td>Perceived Reputation (PR)</td>
<td>PR1</td>
<td>The seller can abide by integrity</td>
<td>Wang and Vassileva, 2007</td>
</tr>
<tr>
<td></td>
<td>PR2</td>
<td>The seller has a good WOM</td>
<td>Ghosh and John, 2009</td>
</tr>
<tr>
<td></td>
<td>PR3</td>
<td>The seller’s firm provide high quality product</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PR4</td>
<td>The seller offers speedy product delivery</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PR5</td>
<td>This website has a high service quality</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PR6</td>
<td>The seller has higher RenQi</td>
<td></td>
</tr>
<tr>
<td>Perceived Security (PS)</td>
<td>PS1</td>
<td>I think this website shows concern for the privacy of its users</td>
<td>Guinaliu, 2005</td>
</tr>
<tr>
<td></td>
<td>PS2</td>
<td>I think this website abides by personal data protection laws</td>
<td>Wang et al., 1998</td>
</tr>
<tr>
<td></td>
<td>PS3</td>
<td>I feel safe when I send personal information to this website</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PS4</td>
<td>I think this website only collects user personal data for its own use</td>
<td></td>
</tr>
<tr>
<td>Consumer Trust (CT)</td>
<td>CT1</td>
<td>This website keeps its promises and commitments</td>
<td>Grazioli and Jarvenpaa, 2000</td>
</tr>
<tr>
<td></td>
<td>CT2</td>
<td>This website does not make false statements</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CT3</td>
<td>This website is trustworthy</td>
<td></td>
</tr>
<tr>
<td>Purchase Intention (PI)</td>
<td>PIN1</td>
<td>The probability that I would consider buying goods from this website is high</td>
<td>Gefen and Devine, 2001</td>
</tr>
<tr>
<td></td>
<td>PIN2</td>
<td>If I were to buy goods, I would consider buying it from this store</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PIN3</td>
<td>My willingness to buy goods from this website is high</td>
<td></td>
</tr>
</tbody>
</table>
RESEARCH METHODOLOGY
The research hypotheses was tested by research methodology, because it enhances the generalizability of the results[22].

Instrument Development
Questionnaire was designed for each construct and the subjects were required to answer all the items based on their impressions of their most frequently shopped(www.taobao.com) website. Measurement items for perceived transparency were taken from Zhu[21] and Granados et al.[22]. Items for perceived reputation were adapted from Wang et al. [3] and Ghosh et al. ([29]) to fit the online context. Items for consumer trust were adapted from Jarvenpaa[13] because of their suitability to the context of this study. Three measurement items are for perceived security and four for purchase intention respectively. All items were measured on a seven-point Likert scale, from “strongly disagree” to “strongly agree”. The measurement items are shown in Table 1. Four information systems scholars and three marketing scholar reviewed the instrument for face validity. The initial version of the survey instrument was pretested by six university professors, each holding significant expertise in the electronic commerce field. After obtaining feedback from these experts, the perceived security and perceived transparency of the measurement items were modified. A focus group of ten people also reviewed the instrument and provided feedback pertaining to the length of the instrument, the clarity of the questions, and the completeness of coverage of the questions.

Sample Selection
The questionnaire addresses the respondents' descriptive information about the website they frequently accessed in Internet shopping in China. The sample data were collected from the general public over 7 weeks in China. In order to maximize a response rate, both online and offline surveys were conducted to collect data. To maintain external validity, we tried to sample data from various group by visiting schools, companies, goverment sectors, and Internet cafes. E-mails and messengers were also employed to collect sample responses. To further prevent biased answers, the survey page assured the respondents that there was no right or wrong answer and that their response would be kept confidential. A total of 410 surveys were distributed, of which a total of 358 were returned (a response rate of 87%). After eliminating 52 responses due to incompleteness or the absence of Internet shopping experience, a sample of 306 (74%) was ultimately employed in our empirical analysis.

EMPIRICAL ANALYSIS AND RESULT
Demographic Analysis
This study requested the respondents apply their most frequent shopped website (www.taobao.com) as the reference in answering the questionnaire. Demographic analysis result are shown in Table 2. The total of female (54.9%) is slightly more than that of male (45.1%). The largest age group was 20–25 (43.1%), followed by 26–30 (23.5%), over 41 (19.6%), and 31–40 (5.9%). As for the educational background, most of the respondents were college graduates (54.3%). The sample was composed mostly of students (35.3%), employee (39.2%), civil servants (13.7%), and self-employed (9.8%). Income representation was divided four groups, the largest income group was ¥3001-5000 per month (39.2%), followed by under ¥2000 (29.4%), ¥2001-3000 (23.5%), and over ¥5000 (7.8%).

Reliability and Validity
The constructs were assessed for convergent and discriminant validity via confirmatory factory analysis (CFA). We first checked the unidimensionality of each construct. Following the recommended methodological procedures[14], we revised the measurement model by dropping, one at a time, measurement items that shared a high degree of residual variance with other items. The CFA showed an acceptable model fit. The results were as follows: the goodness-of-fit index (GFI) = 0.869, the normed fit index (NFI) = 0.936, the adjusted goodness-of-fit index (AGFI) = 0.866, the comparative fit index (CFI) = 0.853, the index (RMR)=0.718 and the root mean square of approximation (RMSEA) = 0.784.

<table>
<thead>
<tr>
<th>TABLE 2. Demographic analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category</td>
</tr>
<tr>
<td>----------</td>
</tr>
<tr>
<td>Gender</td>
</tr>
<tr>
<td>Male</td>
</tr>
<tr>
<td>Female</td>
</tr>
<tr>
<td>Total</td>
</tr>
<tr>
<td>Age</td>
</tr>
<tr>
<td>20 or under</td>
</tr>
<tr>
<td>21–25</td>
</tr>
<tr>
<td>26–30</td>
</tr>
<tr>
<td>31–40</td>
</tr>
<tr>
<td>Over 41</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>
TABLE 3. Results of convergent validity test

<table>
<thead>
<tr>
<th>Item</th>
<th>Construct</th>
<th>Std. path loading</th>
<th>AVE</th>
<th>CR</th>
<th>Cronbach’s alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>PT1</td>
<td>Perceived Transparency</td>
<td>0.604</td>
<td>0.717</td>
<td>0.866</td>
<td>.901</td>
</tr>
<tr>
<td>PT2</td>
<td></td>
<td>0.908</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PT3</td>
<td></td>
<td>0.923</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PT4</td>
<td></td>
<td>0.909</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PS1</td>
<td>Perceived Security</td>
<td>0.791</td>
<td>0.744</td>
<td>0.657</td>
<td>.921</td>
</tr>
<tr>
<td>PS2</td>
<td></td>
<td>0.735</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PS3</td>
<td></td>
<td>0.97</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PS4</td>
<td></td>
<td>0.933</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PR1</td>
<td>Perceived Reputation</td>
<td>0.876</td>
<td>0.629</td>
<td>0.896</td>
<td>.906</td>
</tr>
<tr>
<td>PR2</td>
<td></td>
<td>0.752</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PR3</td>
<td></td>
<td>0.794</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PR4</td>
<td></td>
<td>0.809</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PR5</td>
<td></td>
<td>0.667</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PR6</td>
<td></td>
<td>0.842</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CT1</td>
<td>Consumer Trust</td>
<td>0.766</td>
<td>0.869</td>
<td>0.726</td>
<td>.888</td>
</tr>
<tr>
<td>CT2</td>
<td></td>
<td>0.845</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CT3</td>
<td></td>
<td>0.936</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PI1</td>
<td>Perceived Intention</td>
<td>0.936</td>
<td>0.862</td>
<td>0.948</td>
<td>.948</td>
</tr>
<tr>
<td>PI2</td>
<td></td>
<td>0.902</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PI3</td>
<td></td>
<td>0.946</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Internal consistency of the data was evaluated with three different measures: Cronbach’s alpha, composite reliability, and average extracted variance (AVE). All of the latent variables showed the Cronbach’s reliability coefficient higher than the
minimum threshold value of 0.65 suggested by Lee and Kim[6] or 0.70 suggested by Nunnally [4], which indicates satisfactory internal consistency for confirmation purposes. To provide adequate internal consistency, the value of composite reliability must be greater than 0.7[4]. The AVE reports the proportion of the variance of the measurement items, which is accounted for by a construct. The AVE values of all constructs were greater than 0.50, indicating that over 50% of the variance is explained by the measurement items (see Table 3).

We examined construct validity by assessing the convergent validity and discriminant validity. We ran a principal component analysis (PCA) with varimax rotation for an exploratory purpose. This approach is appropriate because it allows us to retain the measurement items that are most relevant to the constructs by extracting the maximum variance for each construct[17]. The rotation technique provides a clear interpretation and confirms the scientific utility of the solution without compromising the mathematical fit between data and the reproduced correlation matrices. Among orthogonal rotation techniques, varimax is considered to be the default choice because of its ability to simplify factors.

<table>
<thead>
<tr>
<th>TABLE 4. Results of principal components analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Items</td>
</tr>
<tr>
<td>PR1</td>
</tr>
<tr>
<td>PR2</td>
</tr>
<tr>
<td>PR3</td>
</tr>
<tr>
<td>PR4</td>
</tr>
<tr>
<td>PR5</td>
</tr>
<tr>
<td>PR6</td>
</tr>
<tr>
<td>PS1</td>
</tr>
<tr>
<td>PS2</td>
</tr>
<tr>
<td>PS3</td>
</tr>
<tr>
<td>PS4</td>
</tr>
<tr>
<td>PT1</td>
</tr>
<tr>
<td>PT2</td>
</tr>
<tr>
<td>PT3</td>
</tr>
<tr>
<td>PT4</td>
</tr>
<tr>
<td>PIN1</td>
</tr>
<tr>
<td>PIN2</td>
</tr>
<tr>
<td>PIN3</td>
</tr>
<tr>
<td>CT1</td>
</tr>
<tr>
<td>CT2</td>
</tr>
<tr>
<td>CT3</td>
</tr>
</tbody>
</table>

*Note: PR: perceived reputation, PS: perceived security, PT: perceived Trust, PIN: perceived intention, CT: consumer trust.*

We employed latent root criteria to perform item culling. Eigenvalues greater than 1 were selected (Table 4). Factor loadings greater than ±0.45 were considered to be significant for a sample size of 200 or above [23]. Cross-loadings were minimal (i.e., well below the standard maximum cutoff value of 0.4), suggesting that each factor measured its own concept.

<table>
<thead>
<tr>
<th>TABLE 5. Correlations of latent constructs</th>
</tr>
</thead>
<tbody>
<tr>
<td>PT</td>
</tr>
<tr>
<td>PT</td>
</tr>
<tr>
<td>PS</td>
</tr>
<tr>
<td>PR</td>
</tr>
<tr>
<td>CT</td>
</tr>
<tr>
<td>PI</td>
</tr>
</tbody>
</table>
Zhou

Note: Diagonal elements are the square root of AVE. The value should exceed the inter-construct correlations for adequate discriminant validity.

Structural equation model (SEM) was used to validate the causal relationship among variables in the research model. A two-stage analysis method: measurement model and structural model was used for data analysis. Amos 21 software is was used to perform these analyses. The standardized path loadings for all of the questions were statistically significant. The composite reliability and the Cronbach’s alpha for all constructs exceeded 0.7. Furthermore, the average variance extracted for constructs exceeded 0.7,except for the perceived reputation’s value is 0.629. Hence, the convergent validity for the constructs was established(Table 3). The values of all diagonal elements were greater than those of off-diagonal elements, suggesting that all of the constructs were distinct. As shown in Table 5, the reliability and validity tests on the variables confirmed that the survey items were sufficiently valid and reliable for further analyses. Discriminant validity is established if the square root of a construct’s AVE is larger than its correlation with any other construct[5]. The square root of AVE for each construct exceeded the correlation between that construct and other constructs. Hence, discriminant validity was established.

FIGURE 2. Results For the Research Model

Hypothesis Testing
The second step of SEM is to confirm the hypothesized causal relationships among the constructs under study. The results of SEM are presented in Figure 2. Both perceived security and perceived reputation have a significant positive effect on consumer trust, at the same time, both perceived transparency and customer trust have a significant positive effect on purchase intention. But perceived transparency has no significant effect on the consumer trust, the reason is the consumer believe it is normal that the products’ information should be visible and clear. No significant relationship has been found between perceived reputation and purchase intention(Table 6), the reason may be that consumer more emphasis on the product’s quality other than vendor’s reputation. Thus hypotheses H1, H2, H4, and H6 are supported, while H3 and H5 are not supported. Table 7 shows the summary of the results of hypothesis tests.

TABLE 6. The result of path coefficient

<table>
<thead>
<tr>
<th></th>
<th>Estimate</th>
<th>S.E.</th>
<th>C.R.</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consumer Trust</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perceived Security</td>
<td>0.214</td>
<td>0.034</td>
<td>6.266</td>
<td>***</td>
</tr>
<tr>
<td>Perceived Reputation</td>
<td>0.308</td>
<td>0.046</td>
<td>6.683</td>
<td>***</td>
</tr>
<tr>
<td>Perceived Transparency</td>
<td>0.058</td>
<td>0.045</td>
<td>1.291</td>
<td>0.197</td>
</tr>
<tr>
<td>Purchase Intention</td>
<td>0.16</td>
<td>0.039</td>
<td>4.072</td>
<td>***</td>
</tr>
<tr>
<td>Perceived Reputation</td>
<td>0.032</td>
<td>0.042</td>
<td>0.756</td>
<td>0.449</td>
</tr>
<tr>
<td>Consumer Trust</td>
<td>0.578</td>
<td>0.057</td>
<td>10.168</td>
<td>***</td>
</tr>
</tbody>
</table>

Notes: * = significant at 0.05. ** = significant at 0.01 level.
TABLE 7. Summary of hypotheses test

<table>
<thead>
<tr>
<th>Factors</th>
<th>Hypotheses</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consumer Trust</td>
<td>H1: Consumer trust in an Internet shopping context has a positive effect on purchase intention.</td>
<td>Supported</td>
</tr>
<tr>
<td>Perceived Transparency</td>
<td>H2: Perceived transparency in an Internet seller has a positive effect on purchase intention.</td>
<td>Supported</td>
</tr>
<tr>
<td></td>
<td>H3: Perceived transparency in an Internet seller has a positive effect on consumer trust.</td>
<td>Not supported</td>
</tr>
<tr>
<td>Perceived Security</td>
<td>H4: Perceived security in an Internet shopping context has a negative effect on consumer trust.</td>
<td>Supported</td>
</tr>
<tr>
<td>Perceived Reputation</td>
<td>H5: Perceived reputation has a positive effect on consumer trust.</td>
<td>Not supported</td>
</tr>
<tr>
<td></td>
<td>H6: Perceived reputation has a positive effect on purchase intention.</td>
<td>Supported</td>
</tr>
</tbody>
</table>

**IMPLICATIONS AND CONCLUSION**

This study makes several important contributions to the research literature on online customer purchase intention. First, our study empirically investigates the impact of perceived transparency, perceived security and perceived reputation on a consumer’s trust using real-world observations. The data comes from real consumers based on their real transaction experiences from the specific website. This gives the results of our study more generalizability than studies using subjects who are not asked to engage in real transactions.

Second, while prior research has examined the effect of elements of website on online customer shopping ,perceived transparency, which has been largely neglected in the literature, our results indicate that perceived transparency indeed plays an important impact on online customer purchase intention.

Third, during prepurchase phases, Internet vendors should carefully make product information more transparency and to help potential customers to ascertain product quality and information, especially for selling search goods. Thus, clear layout and variety of selection on the website can reduce the customer’s search cost for quality information of experience goods.

As with any research, this paper comes with a number of limitations, which open opportunities for further exploration in future research. First, trust is a multi dimension concept, and the processes of online shopping can also be different. In this research, we only studied perceived transparency, perceived reputation and perceived security as an aggregate measure. However, conceptually, it is possible that some dimensions play a more significant role than others. Therefore, future theoretical investigations are warranted to understand what dimensions of trust are important to consumers’ purchase intention.

**REFERENCES**


THE FORMATION OF THE BIG DATA INDUSTRY AND RELATED STRATEGIES

Shari S. C. Shang, National Chengchi University, Taiwan, sshang@nccu.edu.tw
Sheng-Chi Chen, National Chengchi University, Taiwan, 102356503@nccu.edu.tw

ABSTRACT

Big Data, as moving into the post-cloud era in year 2015, is changing the way software is applied by industries. Meanwhile, the Open Data is transforming the sources of value for software development in which comprehensive digital data value creation is set to be the mainstream in IT application strategies. Big Data applications can enhance the knowledge level of technology applications as well as drive value growth for products and services. The key issue affecting Big Data development is the question of how to leverage mechanisms for joint creation by the general public to identify the value that Big Data can provide. This paper proposes that an effective Big Data industry ecosystem should encompass data owners, application innovators, technology leaders, and open API platforms. Using the methods of design science, the paper evaluates the way in which Big Data creates value in the industrial development process, and argues that it is important to attract mass participation and to satisfy the needs of both industrial and social development when putting forward a value proposition. Moving further, the next step is value creation initiatives, in which the first priority should be to promote the digitalization of industry seeking to create digitalized industries that can contribute to the gradual optimization of the industrial ecosystem as a whole.

Keywords: Big Data, Design science, Government policy, Industry ecosystem, Industry development.

INTRODUCTION

Disruptive innovation is transforming the world at a very rapid pace, and at the same time it is also changing consumer behavior; the continuing evolution of new types of information technology is changing how the “information society” operates. With the development of cloud computing applications, huge quantities of computing operations and data are converging in cloud-based data centers. As the volume of data in these cloud data centers builds up, the need for data analysis becomes ever more pressing. Industry has begun to recognize the potential business opportunities from data applications and the added value that they can create. Government agencies and business enterprises are both faced with the challenge of how to use technology effectively to extract from the data clues that can help in policy implementation or business development.

Big Data has yet to take the form of a fully-fledged industry, as such. The significance of Big Data, and its potential scope of use, is still being interpreted from the perspective of the individual enterprises and people that use it. Currently, no consensus has been reached regarding Big Data in academia. Most of the literature on Big Data restricts itself to examination of data mining technologies and applications, and some studies simply treat Big Data as being synonymous with data mining. [4] The aim of the present study is to help readers develop a clearer picture of the current state of development of Big Data, and of how it should be defined; the study analyses the roles played by individual actors in the Big Data ecosystem during this period prior to the formation of a “Big Data Industry.” It is anticipated that this will help future researchers in this field to clarify potential issues, and will facilitate a more comprehensive exploration of the value generated by Big Data.

RELATED WORKS

Definition and Characteristics of Big Data

With demand for new types of application emerging all the time, data has come to be viewed as a commodity. Commercial needs have led business enterprises to start investing resources in finding data, and in using analytical technology to develop new products and services, thereby helping to support business decision-making and enhance operational efficiency, leading to the emergence of the “data economy,” [8] The term “Big Data” is used to refer to large volumes of data, and more specifically the use of information technology to rapidly access, convert, process and analyze large quantities of data, so that data is transformed into useful information that can be utilized to understand phenomena, forecast trends and provide a reference for decision-making. [1] Market research firm IDC defines “Big Data” as “a new generation of technologies and architectures designed to extract value economically from very large volumes of a wide variety of data by enabling high-velocity capture, discovery and/or analysis.” IDC anticipated strong growth in the global Big Data market over the period 2012-2016, forecasting a compound annual average growth rate (CAGR) for the global Big Data technologies and services market during this period of 31.7%, with total sales revenue forecast to reach US$23.8 billion by 2016. [6] International research and consulting firm Gartner defines “Big Data” as “high-volume, high-velocity and high-variety information assets that demand cost-effective, innovative forms of information processing for enhanced insight and decision-making.” The most widely adopted definitions of “Big Data” emphasize its “3V” characteristics: volume, velocity and variety. [1][2] Other definitions incorporate additional characteristics such as variability, veracity and value, etc. [10][14][16]

“Big Data” thus generally refers to taking quantities of data that are so large they could not be processed manually, and accessing, managing, processing and collating the data within a reasonable space of time so that it is transformed into information that can be interpreted by human users. However, some definitions emphasize not so much the sheer quantity of
data involved, but rather the question of whether or not value can be effectively extracted from the data. Overall, it is difficult to say precisely just how big data has to be in order to qualify as “Big Data.” [7][10][12]

Government Policy
Currently, Big Data technology is evolving rapidly all over the world, and the speed at which innovative new applications are being developed is picking up. Governments have also gradually begun to realize the important role that Big Data can play in promoting economic development, improving public services, and helping to safeguard national security. [8] The U.S. is currently at the forefront of global Big Data development. In March 2012, the U.S. Federal Government launched the Big Data Research and Development Initiative, which aims to strengthen the allocation of resources to basic technical research and public sector applications for Big Data, integrating these efforts with the promotion of Open Data, and incorporating relevant government agencies into the implementation of the Initiative. The British government has also recognized the major benefits that Big Data can provide with respect to policy implementation, and in 2013 allocated £189 million to support Big Data technology R&D; the areas where the British government saw considerable potential for Big Data application development included real-time information management for the public sector, improving citizens’ experience with public services, enhancing the quality of healthcare provision, strengthening compliance with tax legislation, improving welfare provision and preventing fraud and inappropriate use. [5] In March 2014, the Australian government announced the adoption of The Australian Public Service Big Data Strategy, incorporating six basic principles and an action plan; the government expressed the hope that Big Data could be used to enhance the efficiency of government administration, and promote collaboration and innovation; the Strategy notes that Big Data and the related data analysis involve not just the adoption of new technology solutions, but also the transformation of attitudes and organizational culture. [13]

Taiwan is also facing the challenges and opportunities that the era of Big Data presents. Although Taiwan has considerable experience in hardware-software integration, Big Data applications and implementation are still just getting off the ground, and there is a shortage of inter-disciplinary teams (and related experience). There are still many issues that Big Data could help to address to which it has not yet been applied, and Taiwanese industry, universities and research institutes are currently working decide where resources should be allocated. The Taiwanese government has opted for a model that involves collaboration between government and the university sector to establish the Big Data application environment, aiming to cultivate the data analysts and other specialist human talent needed to accelerate the development of Big Data in Taiwan. At the same time, by exploiting the innovation and other capabilities of Taiwan’s universities and research institutes for the purposes of situational and demand-based analysis, the government is able to arrange for in-depth statistical analysis of government data, generating research results that have real value as a reference for government policy implementation, thereby helping the government to achieve its policy goals.

Industry Development
Leading international corporation Amazon analyzes user habit data to forecast customers’ purchasing behavior, and makes use of the EMR (Elastic MapReduce) platform to provide Big Data collection, storage and analysis functions, thereby helping technology developments to acquire a better understanding of consumer characteristics. Google provides tools such as Dataflow and BigQuery, giving technology developers comprehensive data processing channels and the ability to store and analyze Big Data on cloud-based platforms.

As regards corporate applications, companies in some industries have already begun experimenting with Big Data as a means of identifying new business opportunities and improving processes. By and large, these firms have seen an increase in gross profits, and a substantial improvement in productivity. Firms in the retail sector have been able to use social networking to learn more about consumer preferences, making it possible for them to recommend appropriate products to potential consumers; at the same time, retailers can offer discounts for specific products that consumers mention online, and transmit this information to those customers that need it. In the manufacturing sector, comparison of historical data with current equipment status can be used to identify trends and modes in equipment deterioration due to aging, making it possible to predict several weeks in advance when equipment is likely to fail or need to be shut down, and facilitating preventive inspection and diagnostics to avoid breakdowns and stoppages. In the healthcare sector, data relating to past trends can be used to support preventive diagnosis, and integrated services can be developed that combine wearable devices with cloud-based services to permit more timely analysis of medical data. [8][9]

The Big Data movement has already begun to spread from other countries to Taiwan. Leading Taiwanese companies in the hi-tech manufacturing, telecommunications, finance and retailing sectors are already undertaking proof-of-concept verification, seeking to position themselves at the forefront of the adoption of the latest Big Data technologies. It is clear from the pattern of adoption in industry and from the initiatives launched by governments around the world that the development of Big Data presents opportunities for transformation in many different industry sectors. The three key elements in the development of Big Data are data, technology and applications, and Big Data derives its value from three key roles: those played by data owners, application innovators, and technology leaders. [16] Leading international corporations such as Google and Amazon have leveraged their own experience with cloud-based services to begin providing Big Data services for external clients, making use
of Open API technology to enable third parties to access Big Data, analyze it, and use it create added value. [15] Taiwan currently lacks the environment and mechanisms needed to stimulate effective collaboration in the Big Data field; the three key roles are developing independently of one another, and there are problems with a lack of speed and limited resources, which have hindered the development of application services in Taiwan. Of course, it is even more challenging for Taiwanese companies to develop open platforms similar to those of Google or Amazon. Until such time as Big Data develops into a fully- fledged industry, the main emphasis should be on exploring particular aspects and inter-related issues, encouraging industry to move in the direction of cross-industry integration that takes the value proposition as the core concept, as well as on examining how the general public can be got involved in the joint creation of value from Big Data.

**RESEARCH METHOD**

Big Data is already a major focus of discussion in the market. While many enterprises are aiming to use Big Data to solve organizational problems and identify emerging opportunities, they are often unable to verify whether their products and services will meet consumers’ real needs, whether the new technologies involved can solve problems rapidly (and not be subject to replacement within the near future), and whether data access involves questions of data design and licensing mechanisms. [8] Where products or services are developed without following appropriate procedures or without in-depth discussion, there is a risk that such products or services may not be able to satisfy the market’s needs, and that this will not be discovered until after a considerable amount of time and resources has already been wasted unnecessarily. The present study therefore makes use of the design science research methodology proposed by Peffer et al.[11] to examine the question of whether Big Data value creation in relation to government applications and industrial development is adequate to satisfy the value proposition requirements of industrial and social development, and to permit the development of a comprehensive industry eco-system. As shown in figure 1 the research process includes six steps: identify problem and motivate, defining the objectives of a solution, design and development, demonstration, evaluation, and communication with practices to carry out an explicitly applicable solution to a problem, the rigor of an artifact.

![Figure 1. Research Process](image)

Design science is of importance in a discipline oriented to the creation of successful artifacts. [11] It is regarded that ecosystem is an artifact in this study. A topic, defined with social value and business strategy, will be resulted from team-built and co-creation by the process of industry analysis, customer recognition, and value proposition. There developed an artifact that comes to a formed topic by business viability, human values desirability, technology feasibility, and design innovation. As described in table 1, an artifact needs to be examined by the six steps of design science research methodology.

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Identify problem and motivate</td>
</tr>
<tr>
<td>2</td>
<td>Defining the objectives of a solution</td>
</tr>
<tr>
<td>3</td>
<td>Design and development</td>
</tr>
<tr>
<td>4</td>
<td>Demonstration</td>
</tr>
<tr>
<td>5</td>
<td>Evaluation</td>
</tr>
<tr>
<td>6</td>
<td>Communication</td>
</tr>
</tbody>
</table>

**RESEARCH DESIGN**

The value of Big Data lies in the development of cross-device, cross-system and cross-service smart data collection and analysis technologies, and in the ability to use mobile networks to link devices together and speed up the generation of different types of data by business enterprises. The development of the Big Data industry should begin with the forging of consensus regarding the needs of industrial and social development, with the putting forward of value propositions that can serve as the basis for value creation initiatives; the first priority should be to promote the digitalization of industry, before moving on from this towards the creation of digitalized industries, and the gradual formation of a comprehensive industry ecosystem. The present study proposes a model whereby the Big Data ecosystem as depicted in figure 2 is comprised of three key roles – data owners, application innovators, and technology leaders – with open platforms being used to provide data and tools.
Application innovators: These individuals are able to spot opportunities before others notice them, and come up with unique ideas for creating value through data extraction. Those filling this role may not be directly involved with data or technology, but this means that their thinking is not constrained by concerns about practical feasibility.

Data owners: Data owners either own, or are in a position to collect, large amounts of data, and are legally entitled to access these data, either for their own use or by licensing a third party to extract value from the data. This role does not necessarily involve actually working with the data directly, and the data owner may not possess suitable technology for deriving value from the data; the role may not require creative thinking, and the data owner may not actually know whether the data is capable of providing value or not.

Technology leader: This will normally be a consulting firm, technology provider, analytical service provider or data specialist that possesses specialist, practical technology for implementing complex analysis. Those fulfilling this role may not actually possess data themselves, and may not be able to think of creative new uses for data.

Open API platforms: The function of an open application programming interface (API) platform is to provide a data sharing market and data analysis tools, effectively integrating the three key elements of data, technology and applications. Open API platforms provide important opportunities for application innovators, particularly in relation to social media. They can benefit from the assistance of application innovators in developing value-added services for specific market segments, and there is the potential for cross-sectoral integration in the future, with the sharing of data in different fields being used to drive further growth in innovative Big Data applications.

Promoting Strategies
The key to a breakthrough in the development of Big Data applications lies in the formation of consensus regarding value, so that the value proposition of each application is capable of bringing about the formation of a unique industry ecosystem. In terms of Open Data, there is a need to deal with issues relating to data security, personal data, privacy, licensing, incentives for openness, etc. As regards technology adoption, the key issue here is the widespread shortage of data analysis technology and inter-disciplinary data science talent. The present study proposes four strategies for putting the development of the Big Data ecosystem on a sound basis:

1. Building up the Big Data application service environment, and realizing open APIs for data and analytical tools: Promoting an Open Data regulatory framework and incentive mechanisms, and establishing a Big Data application service platform along with guidelines for bringing data and analytical tools onto the platform, together with data application development model and date analysis model guidelines.

2. Cultivation of Big Data human talent: Using the Big Data application service platform to provide data sources and support application testing and community development. Besides focusing on helping data owners to rapidly develop the ability to utilize data in effective ways, there is also a need to encourage collaboration between industry and the university sector to
bring about the launch of Big Data related courses in universities, the holding of themed application development competitions, and collaborative development of data analysis tools and technologies.

3. Using themed services as model projects: Specific industries suited to the introduction of Big Data applications should be selected, and an effort made to identify latent data application needs; model projects could then be launched, such as Industry 4.0, Bank 3.0 or Retail 4.0, described in table 2.

4. An across-the-board expansion of innovative Big Data application services: Through the formation of innovation teams and open innovation collaboration mechanisms, and the holding of seminars and competition, it should be possible to bring together data owners, application innovators and technology leaders to develop inter-disciplinary Big Data service concepts and to develop related applications.

<table>
<thead>
<tr>
<th>Sector</th>
<th>Promotion Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industry 4.0 (Smart Manufacturing)</td>
<td>• Introduction of Cyber-Physical Systems (CPS) – which integrate computing, communications and control functions – into the production process, to create model “smart factories”&lt;br&gt;• Moving from centralized to dispersed production models, and using cloud-based data centers to share data with other regions, permitting real-time monitoring of factory inventory levels and production status, and integrating the upstream and downstream segments of the supply chain</td>
</tr>
<tr>
<td>Bank 3.0 (Financial Service Evolution)</td>
<td>• Emphasizing virtual banking and digital banking, with the development of virtual services that are not dependent on physical infrastructure&lt;br&gt;• Using emerging technologies and applications to drive reform in the financial sector, bringing about the emergence of a steady stream of new personalized, mobile services; the reduced importance of physical branches will rewrite the “rules of the game” in the financial sector</td>
</tr>
<tr>
<td>Retail 4.0 (Retailing Sector Transformation)</td>
<td>• Driving a continued evolution from online shopping e-commerce models towards closer integration of physical and virtual channels&lt;br&gt;• Integrating indoor navigation based on high-precision location based services (LBS) with mobile advertising to provide personalized marketing and enhance the efficiency of service and marketing provision&lt;br&gt;• Transforming physical stores into places where customers can experience new products and services, thereby boosting sales</td>
</tr>
</tbody>
</table>

**CONCLUSION**

Currently, the Big Data industry is still in the early stages of its development, and the roles that need playing within the industry are still somewhat unclear. The industry has yet to achieve economies of scale, and there is a lack of strong commercial incentives for the development of new applications. Although many companies have expressed optimism about the benefits that Big Data applications can provide for industry, large corporations are still dragging their feet when it comes to the development of Big Data applications. Big Data application development can help to strengthen corporate competitiveness and enhance firms’ operational efficiency; in promoting Big Data, specific application fields need to be taken as the starting point, so as to gradually build up data, R&D and testing and analysis models, along with forecasting methods.

Close collaboration with the general public – to benefit from the “wisdom of the crowd” – also has an important role to play in supporting the development of the Big Data industry. Business enterprises and innovation teams should be encouraged to make use of Big Data in developing innovative services and business models; innovation competitions, guidance provision and human talent cultivation initiatives can be used to help industry strengthen its data application capabilities. Taking the needs of industry as the starting point, concepts development by government agencies, universities and research institutes can be verified and examined by open discussion, with business enterprises providing feedback regarding usability and the feasibility of commercialization. Above all, enhancing the quality and value of data in both the public and private sectors is of key importance for ensuring the sound, healthy development of the Big Data industry.

**REFERENCES**


THE IMPACT OF INTERNET OF THINGS TECHNOLOGIES ON SUPPLY CHAIN PERFORMANCE: THE MEDIATING ROLE OF COMPETITIVE STRATEGY

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ABSTRACT
Recent advancement of Internet of Things (IoT) technologies has invoked tremendous attention from both academics and industries. The emerging IoT technologies not only serve as possible new tools for enterprise operation, but also trigger impacts in the management arena such as supply chain management (SCM). This study investigates the role of competitive strategy underlying the link between IoT technologies and supply chain performance. By referring to the resource—strategy—performance model, this study builds a research framework in which three strategic positions of firms—low cost, differentiation and market focus—mediate the effect of IoT technologies on supply chain performance. Empirical survey and analysis of enterprise data are conducted to test the hypotheses. The test results support the mediation effects of competitive strategies. Research contributions and managerial implications are elaborated in the conclusions.

Keywords: Internet of Things, Supply chain performance, Cloud computing, Big data, Mobile app, Sensing, Competitive strategy, Mediation.

INTRODUCTION
The recent trends of information technology development center around the evolution of IoT technology such as cloud computing, big data analytics, and mobile connected applications [9] [14] [15]. These emerging IoT technologies have also invoke tremendous attention from the academics [13] [34]. Facing this flourishing of emerging information technologies, how enterprises react to these technologies becomes an important issue. The IoT technologies are innovative technologies and still under development. Their impacts on supply chain performance have not been thoroughly realized, and deserved further investigation.

By now there is few rigorous research regarding the impact of the emerging IoT technology on firm’s management activities and performance. Since supply chain management is critical to firm’s operation and financial outcome [35], this study will focus on the influence of the emerging IoT technology on firm’s supply chain performance. This study will explore the link between IoT technologies and supply chain performance, and investigate the mediators in the link. Through the research process and results, this study expects to clarify the effect of emerging information technologies on supply chain performance, and also to identify possible mediators and moderators [3] [18] in the effect.

LITERATURE REVIEW

Emerging IoT Technologies
The emerging IoT technologies have attracted attentions as possible sources to strategic advantages for firms [34]. Their influence on economy and society has also attracted the attention of governments and companies worldwide [26]. This study focuses on the emerging IoT technologies embedded in the “new technology stack” depicted in Porter and Heppelmann [34].

Cloud in IoT
The innovation of cloud has made a major impact on the products, services and business models of the IT software and hardware industries [1] [38] [42]. Cloud computing has therefore become an emerging concept and technology that has drawn attention from the IT software and hardware industries. The scope of the industry as well as the fact that it spans both the enterprise and consumer markets has led to much discussion on its future business potential [10] [17] [22]. Nevertheless, cloud computing technologies and business models as well as the new products, services, competition and alliances that arise as a result offer an emerging market that is well worth monitoring [12].

Sensing in IoT
There are various IoT infrastructure and application prototypes. Near Field Communication (NFC) [27] [39] evolved from Radio-Frequency Identification (RFID) [16] and interconnection technology. In the past, non-contact chips were always produced as card applications. In recent years, chips have been embedded into mobile devices for greater convenience. Mobile devices have therefore been turned into a payment tool that allows downloading and payment of services in any public setting and can also be used for exchanging data on mobile devices. This development extends the possible applications of smart, connected products and the product clouds [34].

Big data analytics in IoT
“Big data” refers to the technology applied in big, immediate and manifold structured and unstructured information. It helps companies store, transform, transmit and analyze huge amounts of information [28]. It also provides advanced business analytics, develops business intelligence and leads to gains in business values [5]. As the rapid growth of cloud computing,
electronic commerce, social media, internet of things and mobile devices, data volume grew explosively, and makes companies all over the world started to pay attention to big data related technology [25]. Big data technology means to use computing processes such as storing, transforming, streaming, transferring and analyzing to handle structural or non-structural data that are dynamic, massive and variable, for the business benefits [19]. The use of big data is to perform instant and complex analysis to massive dynamic data, and support companies’ decision-making in a short period of time. The rise of big data has provided new opportunities for future ICT industries and data scientists [20].

**Mobile app in IoT**

The Connectivity and Smart Mobile Applications embedded in “things” are used to establish exchange of information in a mobile and ubiquitous way [13] [34]. In order to provide ubiquitous mobile computing, infrastructure of wireless communication network need to be constructed first. Currently, various IoT networking infrastructure are under development [2], most of which are based on wireless sensor networking [31].

**Information security in IoT**

Porter and Heppelmann [34] describes identity and security as “Tools that manage user authentication and system access, as well as secure the product, connectivity, and product cloud layers.” This description of identity and security comprises cloud security and device security. Cloud security software technology has two dimensions. One dimension is the adoption of IT security technology, products or services by businesses to improve the security of cloud services. This is known as “Security for the Cloud” [21]. The other dimension is the use of cloud computing by IT security vendors to strengthen, expand or transform their existing IT security technologies and services. This is known as “Security as a Service”. Device security involves Mobile Device Management (MDM) and Mobile Data Protection (MDP). One controls physical mobile devices while the other secures data saved in mobile devices, including user authority and privacy [11] [37].

**Supply Chain Management**

The goal of supply chain management (SCM) is to facilitate the efficient and effective movement of products, services, finances, and information from a provider to a consumer. SCM is not only essential for effective production, distribution, and logistical performance of today’s companies, but can also influence their strategic posit [41]. Understanding how firms can profit from their supply chain management is highly important for both management practitioners and academics [7]. Prior research has characterized SCM as fundamentally changing the enterprise competition and evolving as a part of firm’s new dominant strength [43]. Investigators have argued that the firm’s practices for leveraging associations with supply chain can be fundamental to sustaining a competitive advantage in the market [35].

**HYPOTHESES DEVELOPMENT**

**The Impact of IoT Technologies on Supply Chain Performance**

Zhang et al. [45] conduct a systematic review of literature on the period of 1995 to mid-2010 and find that a majority of papers confirm a positive relationship between IT and supply chain performance. DeGroote and Marx [7] investigate the impact of information technology on supply chain agility measured by the ability to sense and respond to market changes. Their data are collected from supply chain executives at 193 U.S. manufacturing firms. The results suggest that IT improves the supply chain’s ability to sense market changes by improving the adequacy, accuracy, accessibility, and timeliness of the information flows among members of the supply chain. It is therefore hypothesized:

H1: There is a significant association between IoT technology and supply chain performance.

**The Role of Competitive Strategy**

Porter’s framework for competitive strategy is one of the most widely accepted business competition models [29]. Porter’s research in industrial economics suggests three generic strategies of competing above average rates of return: low cost, differentiation and focus [32] [33].

**Low cost**

By now there are few studies of how companies compete in a market in terms of IoT can be related with low cost strategy. However, previous studies have shown that the integration of information technology with supply chain management can reduce the cost of information exchange between parties in the supply chain, and thus impacting the supply chain performance [8] [35]. Therefore, we propose that emerging information technology indirectly affects firm performance by increasing efficiency and driving down costs, implying that emerging information technology significantly affects a firm’s low cost position, leading to superior supply chain performance. It is thus hypothesized:

H2a: There is a significant association between IoT technology and low cost strategy position.

H2b: There is a significant association between low cost strategy position and supply chain performance.

H2c: Low cost mediates the relationship between IoT technology and supply chain performance.

**Differentiation**

Adoption of IoT technologies may enable a firm to obtain in-depth information about its suppliers and customers and then use
this knowledge to adapt its offerings to meet the needs of its supply chain operations in a better way than does its competitors. Therefore, the emerging information technology is linked to the business strategy of differentiation, which enables firms to achieve superior performance. This link is consistent with the sources→positions→performance framework, with emerging IoT technology as the source that allows firms to achieve a differentiated position, which in turn drives firm’s supply chain performance [6].

H3a: There is a significant association between IoT technology and differentiation strategy position.
H3b: There is a significant association between differentiation strategy position and supply chain performance.
H3c: Differentiation mediates the relationship between IoT technology and supply chain performance.

**Market focus**

With a focus strategy, a firm concentrates its efforts on a specific market segment [32]. There have been no extensive empirical studies of the behavior and performance of firms competing on the basis of focus strategy. Koo et al. [24] examined Porter’s competitive strategies in electronic virtual markets and find that on-line firms incline to differentiation strategy, whereas click-and-mortar firms prefer strategies based on focus strategy. Both on-line firms and click-and-mortar firms are pioneer adopters of emerging IoT technologies such as cloud computing and big data analytics. We thus hypothesize:

H4a: There is a significant association between IoT technology and market focus strategy position.
H4b: There is a significant association between market focus strategy position and supply chain performance.
H4c: Market focus mediates the relationship between IoT technology use and supply chain performance.

Drawing from these hypotheses proposed above, the research framework is depicted in Figure 1.

![Figure 1. Research framework](image)

**RESEARCH METHOD**

**Survey Instrument**
The survey instrument is developed with questions derived from the literature on emerging information technologies, Porter’s competitive strategies, resource→strategy→performance framework, and supply chain performance discussed above. We operationalize the study variables using multi-item reflective measures on a seven-point scale (Jarvis et al. 2003). Table 1 summarizes the independent and dependent variables, which are further elaborated below.
<table>
<thead>
<tr>
<th>Construct</th>
<th>Operational Definition</th>
<th>Supporting Literature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emerging information technology</td>
<td>A firm’s intention to adopt the emerging IoT technology</td>
<td>Armbrust et al. [1] [Cegielski et al. [4]</td>
</tr>
<tr>
<td>Low cost</td>
<td>A firm’s posture of competition based on lower cost of operation and resource relative to the firm’s competitors.</td>
<td>Koo et al. [24] Reimann et al. [36] Oltra and Luisa Flor [30]</td>
</tr>
<tr>
<td>Differentiation</td>
<td>A firm’s ability to compete by being unique within their industry in a number of perspectives.</td>
<td>Koo et al. [24] Reimann et al. [36]</td>
</tr>
<tr>
<td>Market Focus</td>
<td>A firm’s ability to compete by targeting specific groups of buyers, product lines, product lifecycle, or geographic areas.</td>
<td>Koo et al. [24] Kim et al. [23]</td>
</tr>
</tbody>
</table>

Table 2 presents the items used to measure each of the independent and dependent variables.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intention of IoT technology adoption</td>
<td>(1 – to no extent; 4 – to some extent; 7 – to a great extent)</td>
</tr>
<tr>
<td>IoT1: Cloud in IoT</td>
<td></td>
</tr>
<tr>
<td>IoT2: Sensing in IoT</td>
<td></td>
</tr>
<tr>
<td>IoT3: Big data analytics in IoT</td>
<td></td>
</tr>
<tr>
<td>IoT4: Mobile app in IoT</td>
<td></td>
</tr>
<tr>
<td>IoT5: Security and privacy in IoT</td>
<td></td>
</tr>
<tr>
<td>Low cost strategy orientation</td>
<td>(1 – strongly disagree; 7 – strongly agree)</td>
</tr>
<tr>
<td>CL1: Developing products or services with lower cost</td>
<td></td>
</tr>
<tr>
<td>CL2: Delivering products or services with lower price</td>
<td></td>
</tr>
<tr>
<td>CL3: Providing products or services in large quantity or scale</td>
<td></td>
</tr>
<tr>
<td>Differentiation strategy orientation</td>
<td>(1 – strongly disagree; 7 – strongly agree)</td>
</tr>
<tr>
<td>DF1: Differentiating products and services based on operational efficiency</td>
<td></td>
</tr>
<tr>
<td>DF2: Differentiating products and services based on innovation</td>
<td></td>
</tr>
<tr>
<td>DF3: Delivering products or services with superior functionality in current market</td>
<td></td>
</tr>
<tr>
<td>DF4: Delivering products or services with innovative business model</td>
<td></td>
</tr>
<tr>
<td>Market focus strategy orientation</td>
<td>(1 – strongly disagree; 7 – strongly agree)</td>
</tr>
</tbody>
</table>

The Fifteenth International Conference on Electronic Business, Hong Kong, December 6-10, 2015
MF1: Focusing in a niche market segment
MF2: Focusing in first to market position
MF3: Focusing in market position as a fast follower
MF4: Focusing in a mature market segment

Supply Chain Performance
(1 – greatly below average; 4 – average; 7 – greatly above average)

SCP1: Delivering products or services on time
SCP2: Reducing lead time
SCP3: Responding to changes of customer requirement
SCP4: Avoiding lack of critical resources
SCP5: Inventory and logistics flexibility
SCP6: Reducing cost of the whole supply chain management
SCP7: Reducing inventory cost

Sample and Data Collection
Empirical data to test the hypothesized relationships is obtained by using a survey of large Taiwanese companies. An online questionnaire developed in accordance with Table 2 above is implemented as the survey instrument. It is pre-tested in an iterative manner among a sample of 15 executives and supply chain managers. The questionnaire items is revised on the basis of results of the expert interviews and refined through rigorous pre-testing to establish content validity. Table 3 shows the profile of the sampling list.

<table>
<thead>
<tr>
<th>Industry</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>High-tech manufacturing</td>
<td>946</td>
<td>41%</td>
</tr>
<tr>
<td>Other manufacturing</td>
<td>332</td>
<td>14%</td>
</tr>
<tr>
<td>IT and Telecom services</td>
<td>450</td>
<td>20%</td>
</tr>
<tr>
<td>Other services</td>
<td>301</td>
<td>13%</td>
</tr>
<tr>
<td>Retail and wholesale</td>
<td>271</td>
<td>12%</td>
</tr>
<tr>
<td>Total</td>
<td>2,300</td>
<td>100%</td>
</tr>
</tbody>
</table>

RESULTS
Table 4 summarizes the descriptive statistics, reliability and validity tests.

<table>
<thead>
<tr>
<th>Construct</th>
<th>Item</th>
<th>Mean</th>
<th>SD</th>
<th>Cronbach’s alpha</th>
<th>Cronbach’s alpha if item deleted</th>
<th>Factor loading on single factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>IoT</td>
<td>IoT1</td>
<td>4.12</td>
<td>1.554</td>
<td>0.886</td>
<td>0.870</td>
<td>0.782</td>
</tr>
<tr>
<td></td>
<td>IoT2</td>
<td>4.58</td>
<td>1.564</td>
<td>0.860</td>
<td>0.830</td>
<td></td>
</tr>
<tr>
<td></td>
<td>IoT3</td>
<td>4.45</td>
<td>1.619</td>
<td>0.861</td>
<td>0.824</td>
<td></td>
</tr>
<tr>
<td></td>
<td>IoT4</td>
<td>4.71</td>
<td>1.554</td>
<td>0.869</td>
<td>0.784</td>
<td></td>
</tr>
<tr>
<td></td>
<td>IoT5</td>
<td>4.99</td>
<td>1.500</td>
<td>0.873</td>
<td>0.765</td>
<td></td>
</tr>
<tr>
<td>Low Cost</td>
<td>CL1</td>
<td>4.46</td>
<td>1.414</td>
<td>0.719</td>
<td>0.724</td>
<td>0.732</td>
</tr>
<tr>
<td></td>
<td>CL2</td>
<td>3.72</td>
<td>1.521</td>
<td>0.596</td>
<td>0.824</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CL3</td>
<td>3.60</td>
<td>1.460</td>
<td>0.557</td>
<td>0.842</td>
<td></td>
</tr>
<tr>
<td>Differentiation</td>
<td>DF1</td>
<td>4.55</td>
<td>1.371</td>
<td>0.905</td>
<td>0.893</td>
<td>0.854</td>
</tr>
<tr>
<td></td>
<td>DF2</td>
<td>4.39</td>
<td>1.375</td>
<td>0.857</td>
<td>0.921</td>
<td></td>
</tr>
</tbody>
</table>
### Table 5. Construct correlation

<table>
<thead>
<tr>
<th>Construct</th>
<th>IoT</th>
<th>CL</th>
<th>DF</th>
<th>MF</th>
<th>SCP</th>
</tr>
</thead>
<tbody>
<tr>
<td>IoT Technology</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low Cost</td>
<td>CL</td>
<td>0.324**</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Differentiation</td>
<td>DF</td>
<td>0.356**</td>
<td>0.647**</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Market Focus</td>
<td>MF</td>
<td>0.421**</td>
<td>0.663**</td>
<td>0.864**</td>
<td>1</td>
</tr>
<tr>
<td>Supply Chain Performance</td>
<td>SCP</td>
<td>0.362**</td>
<td>0.622**</td>
<td>0.650**</td>
<td>0.759**</td>
</tr>
</tbody>
</table>

**p < 0.01

Table 6 summarizes the test results of the hypothesized model.

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Coefficient</th>
<th>p-value</th>
<th>Test Result</th>
<th>VIF</th>
<th>Mediated</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1  IoT → SCP</td>
<td>0.362***</td>
<td>0.000</td>
<td>Supported</td>
<td></td>
<td></td>
</tr>
<tr>
<td>H2a IoT → CL</td>
<td>0.324***</td>
<td>0.000</td>
<td>Supported</td>
<td></td>
<td></td>
</tr>
<tr>
<td>H2b CL → SCP</td>
<td>0.622***</td>
<td>0.000</td>
<td>Supported</td>
<td></td>
<td></td>
</tr>
<tr>
<td>H2c IoT → SCP</td>
<td>0.180**</td>
<td>0.002</td>
<td>Supported</td>
<td>1.118</td>
<td>Partial</td>
</tr>
<tr>
<td>H3a IoT → DF</td>
<td>0.356***</td>
<td>0.000</td>
<td>Supported</td>
<td></td>
<td></td>
</tr>
<tr>
<td>H3b DF → SCP</td>
<td>0.650***</td>
<td>0.000</td>
<td>Supported</td>
<td></td>
<td></td>
</tr>
<tr>
<td>H3c IoT → SCP</td>
<td>0.150**</td>
<td>0.009</td>
<td>Supported</td>
<td>1.145</td>
<td>Partial</td>
</tr>
<tr>
<td>H4a IoT → MF</td>
<td>0.421***</td>
<td>0.000</td>
<td>Supported</td>
<td></td>
<td></td>
</tr>
<tr>
<td>H4b MF → SCP</td>
<td>0.759***</td>
<td>0.000</td>
<td>Supported</td>
<td></td>
<td></td>
</tr>
<tr>
<td>H4c IoT → SCP</td>
<td>0.052</td>
<td>0.304</td>
<td>Rejected</td>
<td>1.215</td>
<td>Complete</td>
</tr>
<tr>
<td>MF → SCP</td>
<td>0.737***</td>
<td>0.000</td>
<td>Supported</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*p < 0.05, **p < 0.01, ***p < 0.001

Table 5 summarizes the correlation between constructs.
CONCLUSIONS

Research Contributions
This study investigates the impact of IoT technology on supply chain performance, mediated by the firm’s position of competitive strategy. The empirical results demonstrate that emerging IoT technology such as cloud computing, big data and mobile app [13] [34] influences the supply chain performance such as reducing cost, increasing flexibility and shortening time. The results also verify the mediating role of Porter’s theory of generic strategy [32] [33] on the link between IoT technology and supply chain performance. Finally, these results also make a solid case for the the sources→strategy→performance framework of competitive strategy [6] [40].

Managerial Implications
Supporting these research hypotheses, the insight we obtain from our empirical results is that the link between IoT technology and supply chain performance is fully mediated by the strategies of firms. That is, the link between IoT technology and supply chain performance is not direct, but rather indirect. By adopting a mediational framework such as in this study, managers could realize different strategy position in the IoT links to supply chain performance. To the best of our knowledge, this is the first empirical study to investigate critical mediators in the IoT-SCM link as well as to examine IoT technologies in the context of business strategies.

Research Limitations
Although this study reports meaningful implications toward the development of factors that influence supply chain performance, we recognize that the validity of an instrument cannot be universally established on the basis of a single study. Especially, data used for tests in this study were all collected in firms located in Taiwan. Though Taiwan is a relatively efficient and competitive arena for accepting innovative information technology, it has its unique industry environment and culture. It is therefore suggested for SCM practitioners and academicians to interpret our findings as a reference model, rather than generalizing our results in all emerging technologies and economics.

REFERENCES

The Fifteenth International Conference on Electronic Business, Hong Kong, December 6-10, 2015


THE IMPACT OF THE COLLECTIVE RATING PRESENCE ON CONSUMERS’ PERCEPTION

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ABSTRACT
In online markets, collective ratings by prior buyers are often displayed in a marked place and influential for later consumers. While the aggregated ratings transfer overall evaluation towards products, they might also bring biases to potential consumers. In this study, we hypothesize that collective rating, as a piece of information, acts as 1) a predisposition which affects people’s perception towards other information; and 2) a risk level of product’s performance which changes the way people perceive consensus or deviant word-of-mouth information from online reviews. Using online reviews of multiple product categories from Amazon.com, our study reveals the impact of collective ratings on consumers’ perception of WOM information and sheds light upon the conflictive results on perception biases of product reviews. Implication for understanding and facilitating consumer perception of online reviews are discussed.

Keywords: Collective rating, online product reviews, predisposition, perceived risk, helpfulness.

INTRODUCTION
Online markets facilitate our life by providing convenient and fast shopping experiences. In the past two decades, many information systems and marketing researchers have been exploring the factors of market success in online context.

To mitigate the information asymmetry due to the Internet nature, many platforms began to use review systems, which encourage buyers to post their experiences and evaluation of products. By reading prior buyers’ rating and text content, potential consumers can optimize their purchase decisions [13]. However, as the amount of information increases, potential consumers are overwhelmed by a large amount of information with uncertain quality and credibility. In addition, there are also marketers and reviewers who post fake reviews for certain benefits. In order to help consumers identify the product quality with less time and efforts, two approaches are commonly adopted by shopping websites on their review systems. The first approach is the collective rating information. Figure 1 is an example on the shopping website Amazon.com. The collective evaluation approach displays an aggregate evaluation from buyers who post reviews of the product. The evaluation is shown by either a number or a distribution diagram. The aggregated rating information helps identify good products. Potential buyers can quickly obtain knowledge of product evaluation or use it to search for products within their requirement of product quality. Past research has shown that sellers and marketers benefit from the aggregated average rating, since the rating is positively associated with the product price, sales and the trustworthiness of sellers [3][6][8][9][10][15][33][37][47].

![Customer Reviews](image)

Figure 1. Collective rating information of customer reviews on Amazon

The second approach is a voting mechanism which allows customers to vote for reviews that they feel helpful or unhelpful regarding their purchase decision, as shown in Figure 2. The voting information is displayed as, for example, “32 of 40 people found the following review helpful”. With higher helpfulness, reviews are more likely to be read and considered. Therefore, the helpfulness votes are important in identifying good reviews and hence good products.
A number of studies focus on how people perceive review information. Early research explored that review helpfulness could be determined by reviews’ observable features and reviewers’ characteristics, such as review age, review length, and reviewer’s expertise [11][31][34][41]. Also, content analyses have been applied by scholars to investigate review helpfulness, suggesting that more readable, subjective, and emotional reviews tend to be perceived more helpful [7][29][45][46].

Although past work has studied collective ratings functions and helpfulness voting behaviors intensively, there is limited study of their connections when the two approaches both facilitate consumers in identifying good products. A motivating scenario is: when a customer considers buying a particular product, she might first refer to the product average rating for an impression of that product’s perception, and the effects of review helpfulness as diagnostic perception. In our study, we share the same interest in the overall perception of word-of-mouth information. We address this question by presenting a framework to examine the multiple roles of collective ratings, and then applying this framework to the perception of review helpfulness.

Our study focuses on the interaction effect of collective ratings and helpfulness voting mechanism. We ask the following research questions: Will the presence of the product collective rating introduce biases or change the way people perceive word-of-mouth information? We address this question by presenting a framework to examine the multiple roles of collective ratings, and then applying this framework to the perception of review helpfulness.

Our work adds to an increasing number of studies exploring the helpfulness perceptions of online reviews. Instead of studying how people vote for reviews with different review features, we expand our focus to a broader perspective of information flow in the online review settings. We argue that the collective ratings, directly and indirectly, affect the way people perceive review helpfulness. Our findings also give explanations to the inconsistent findings of helpfulness perception biases.

**THEORY BACKGROUND AND HYPOTHESES**

According to Mudambi et al. [34], online review is defined as peer-generated product evaluation posted on company or third party websites and helpful online reviews are those facilitate consumers purchase decisions. Buyers and sellers can both benefit from helpful online reviews. For buyers, obviously, review helpfulness helps reduce their search costs. For marketers, they could obtain a strategic advantage in consumer attention by identifying and displaying helpful reviews [11][46].

In studying the consumers’ perception towards word-of-mouth information, we make use of review helpfulness for the following reasons. First, in online review context, review helpfulness is consistently defined as a reflection of the diagnosticity value of a review [25][34]. Diagnosticity perception displays a diverse and integrated consumer perception. Hoch et al. [23] define perceived diagnosticity as the extent to which it helps the consumer assign a product to one (and only one) cognitive category. Jiang et al. [26] bring the definition into online context and used it to represent consumers’ cognitive belief that a website facilitates their product understanding. In this study, we are interested in the overall perception of word-of-mouth information, which might include various dimensions, such as credibility, importance, relevance, informativeness, accuracy and so on. Review helpfulness, as an integrated reflection, fits our purpose of the study.

Second, in the domain of information processing, review information is processed in multiple stages. Kuan et al. [29] posit that message evaluation is based on not only the effect of comprehension, but also the impact of attention. While vivid reviews tend to attract readers’ attention and are more likely to be voted [35], they are not necessarily more diagnostic than pallid information [22]. To avoid misinterpreting readers’ evaluation of review information, they examine the effects of review votes as vividness perception, and the effects of review helpfulness as diagnostic perception. In our study, we share the same emphasis on the comprehension outcome of the review information. Therefore, we follow the extant studies and adopt the overall helpfulness perception as a proxy of review diagnosticity.
One common finding of helpfulness perception is negativity bias, that reviews with negative ratings are more likely to be helpful [7][29][46]. The arguments are based on the consistent evidence of generalized negativity bias in multiple disciplines, for that bad things are rare and revealing [20], and they receive more attention and more thorough processing than good things [5]. Meanwhile, Pan et al. [36] propose an opposite view. They conclude that positive reviews are more helpful than negative ones, because positively-rated reviews are more congruent with consumers’ predispositions and more likely to be perceived helpful. However, both of the two biases neglect the role of actual collective product ratings that the readers are disposed, as the collective information can introduce prior beliefs to readers about the products.

**Prior Belief**

Prior belief, or predisposition towards a product, has the potential to affect a person’s judgment of WOM information in assessment process [1][12][44]. From the perspective of covariation assessment, Alloy et al. [1] proposed that when doing evaluation, prior expectation and currently available information contribute and interact in the assessment process. They suggest that the stronger the individuals’ prior beliefs, the more the feelings will dominate the interpretation and use of information. Wilson et al. [44] found that no matter the predisposition was newly established or well-founded, the results are the same.

We define consensus information as information consistent to the prior beliefs and deviant information as one that contradicts the prior beliefs. Levin et al. [30] applied intuitive statistics paradigm and concluded that subjects will discount deviant information in making an inference from a sample to a population when they recognize such information to be unrepresentative of the population. Crocker [12] also provided ideas from the covariation processing perspective. Although deviant information can be processed at a deeper level and easier to recall, but if the incongruence can be explained so that it makes sense in the context of the other information, then it is no longer incongruent or the incongruence is qualified and limited [12]. In this way, the deviant information is likely to be recalled but with little influence on assessment process. Hoch et al. [23] explained the impact of predisposition from another angle. They held the opinion that prior impressions are persistent and hard to be changed by other information, even by a contradicted information, because 1) any ambiguous information is interpreted as consistent to expectancies, 2) any consistent information to expectancies increases confidence to expectancies, and 3) any inconsistent information is discounted or ignored [22][23]. In online shopping websites, consumers normally confront various products they may or may not have heard of. Since collective rating information can always provide prior beliefs about the products, consumers’ receptivity to WOM information can be determined by the “fit” with the predispositions. Hence, collective rating will directly influence the helpfulness perception so that consensus information will be more favored than deviant information. Therefore, we hypothesize that,

Hypothesis 1. A review whose rating is closer to the prior collective rating is more likely to be perceived diagnostic.

**Perceived Performance Risk**

Besides a predisposition, the collective rating in online markets provides the satisfaction perception of the product/service item. Since consumer behavior can be viewed as risk taking [4][27], it is essential for online consumers to reduce the risk level by pre-purchase information acquisition [19].

Extant research has defined six components of perceived risk, namely financial, physical, psychological, performance, social, and time-related risk [43]. The collective evaluation of product given by prior product reviews provides a relatively objective evaluation of the product performance. The higher the evaluation is, the more certainty consumers will perceive upon the item and the less the performance risk will be. Since performance risk occurs when the product chosen might not perform as desired and thus not deliver the benefits promised [24], interpreting the collective rating as a measure of performance value is consistent with the notion of the perceived risk in business context.

One might wonder the relationship between performance risk and the product uncertainty concept in Dimoka et al. [14]. Product uncertainty is defined as the buyers’ difficulty in evaluating the product and predicting how it will perform in the future [14]. In our research, performance risk is different from product uncertainty. A high level of product uncertainty indicates a situation where buyers are more difficult to evaluate the product, while a high performance risk suggests that the product is more likely to have a low quality.

WOM is an important risk reliever for consumers at pre-purchase phase [19][40], but the impact of WOM is different as a function of perceived risk. Arndt [2] showed that comparing to low-risk perceivers, the high-risk perceivers tended to make more efforts to seek word-of-mouth information. The high riskers are more active in various WOM sources, such as starting pre-purchase conversation, listening to comments, requesting more information and so on. Online markets have made the approaches of obtaining WOM information easier, so online consumers are more likely to initiating searching behaviors.

Since product rating implies the risk of the purchase, it is inferred that high product rating presents a low-risk purchase environment, and low product rating invokes high-risk perception. Therefore in our context, we posit that consumers are less open, and less willing to accept various information when evaluating products with low risks, than they are when evaluating products with high risks. To summarize, we hypothesize that,
Hypothesis 2: The deviant information is perceived more diagnostic for products with high risk, and consensus information is perceived more diagnostic for products with low risk.

METHODOLOGY

To test these hypotheses, we conduct an empirical study on a real-world setting of online shopping platform.

There are several reasons to choose the Amazon website to test our hypotheses. First, Amazon is one of the biggest online markets all over the world and consistently has the largest number of posted reviews [36]. Many prior studies of online reviews have been conducted on Amazon. Our findings could potentially possess more generalizability as they are produced on the typical and influential online market. Second, previous studies delivered inconsistent results of rating biases by Amazon data. As our research provides alternative views of consumers’ shopping behavior, it is better to test our hypotheses by data from the same source.

The data we use were collected by the Stanford Network Analysis Project (http://snap.stanford.edu/index.html) [32]. Seven categories were chosen in our pilot test, including Electronics, Gourmet & Food, Health, Home & Kitchen, Musical Instrument, Sports & Outdoors, and Tools & Home Improvement. We discarded products that were launched before the helpfulness voting mechanism was added, resulting products whose launch time are more than 2,500 days from now to be deleted. Therefore, our pilot dataset contains a sample of 213,934 reviews on 52,022 products. Following is a description table for the data we collected.

<table>
<thead>
<tr>
<th>Category</th>
<th># Products</th>
<th># Reviews</th>
<th>Avg. #reviews/product</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electronics</td>
<td>7,493</td>
<td>33,668</td>
<td>4.49</td>
</tr>
<tr>
<td>Gourmet &amp; Food</td>
<td>3,251</td>
<td>11,294</td>
<td>3.47</td>
</tr>
<tr>
<td>Health</td>
<td>7,930</td>
<td>33,563</td>
<td>4.23</td>
</tr>
<tr>
<td>Home &amp; Kitchen</td>
<td>9,421</td>
<td>39,188</td>
<td>4.16</td>
</tr>
<tr>
<td>Musical Instrument</td>
<td>2,986</td>
<td>11,218</td>
<td>3.76</td>
</tr>
<tr>
<td>Sports &amp; Outdoor</td>
<td>8,744</td>
<td>36,264</td>
<td>4.15</td>
</tr>
<tr>
<td>Tools &amp; Home improvement</td>
<td>12,724</td>
<td>48,739</td>
<td>3.83</td>
</tr>
<tr>
<td>IN TOTAL</td>
<td>52,549</td>
<td>213,934</td>
<td>4.07</td>
</tr>
</tbody>
</table>

Measures

We use review helpfulness as our dependent variable (Helpfulness). We measure review helpfulness by the ratio of the helpful votes to the total votes received by a review.

To measure how close the review rating is to the average product rating, we introduce information disparity (InfoDisparity), which is the absolute difference from a review’s rating to the average product rating at that time. To measure it, first, we sort the reviews under each product according to their posting time. Second, we calculate the moving average score of the product when each review was posted. Third, the InfoDisparity for each review is calculated. As we explained above, we measure the perceived shopping risk for each product by the overall average rating score of the product (Avg.ProductScore) that the consumers are reviewing.

At the same time, following prior research, we controlled a series of relevant variables on product level and review level. On product level, we use the launched time of product (LaunchTime), price (Price) and the number of reviews under the product (ReviewNum) as control variables. On review level, we use control the elapsed time of review (ElapsedTime) as a proxy of review age, review’s word count (WordCount), reviewer’s expertise (UserExp), and also some review’s textual features.

Past research has found that many textual features of online review could influence the diagnosticity perception, such as readability, subjectivity, certainty and sentiment. We therefore control them in our research by using various content analysis techniques. First, to control for the reviews’ readability level (Readability), we calculated the Gunning Fog Index. It estimates the years of formal education needed to understand the text on a first reading [18], and had been used in many online review studies of IS discipline [17][28]. Second, to measure the texts’ subjectivity level (Subjectivity), we prepared the subjectivity and objectivity classifiers and calculate the percentage of subjectivity in review content, following the approach of Ghose et al. [16]. Third, we used a dictionary provided by the Linguistic Inquiry and Word Count (LIWC), which was developed by Pennebaker et al. [39] and designed to calculate the degree to which people use different categories of words across a wide array of words. We applied LIWC to calculate the words that appear in categories of certainty (Certainty), positive sentiment (Positive) and negative sentiment (Negative). At last, we used Uniqueness to measure the uniqueness words in each review under a particular product item. It was calculated by the percentage of new words that appear in a review and have not been found in the previous reviews for the certain product.

The descriptive statistics of the variables are listed in Tables 2.
Because there are no observations on the mean and standard deviations of helpfulness unless there is at least one vote, a potential selection bias might exist in our sample [34]. We therefore follow the approach of Kuan et al. [29], using a two-step procedure with a Heckman selection model [21]. Also, it might not be meaningful to calculate the mean and standard deviation of helpfulness percentage when there is only one vote for the review. So we also examine the robustness of results using different minimum numbers of votes to estimate review helpfulness.

The models that we estimate are as follows.

\[
\text{Voting}_k = \alpha_1 \ast \text{Avg.ProductScore} + \alpha_2 \ast \text{Avg.ProductScore} \ast \text{InfoDisparity} + \alpha_3 \ast \text{InfoDisparity} + \alpha_4 \ast \log(\text{UserExp}) + \alpha_5 \ast \text{Readability} + \alpha_6 \ast \text{Subjectivity} + \alpha_7 \ast \text{Certainty} + \alpha_8 \ast \text{Positive} + \alpha_9 \ast \text{Negative} + \text{Uniqueness} + \alpha_{11} \ast \log(\text{ElapsedTime}) + \alpha_{12} \ast \log(\text{WordCount}) + \alpha_{13} \ast \text{LaunchTime} + \alpha_{14} \ast \text{Price} + \alpha_{15} \ast \text{ReviewNum} + \mu
\]

\[
\text{Helpfulness} \mid (\text{Voting} \geq k) = \beta_1 \ast \text{Avg.ProductScore} + \beta_2 \ast \text{Avg.ProductScore} \ast \text{InfoDisparity} + \beta_3 \ast \text{InfoDisparity} + \beta_4 \ast \log(\text{UserExp}) + \beta_5 \ast \text{Readability} + \beta_6 \ast \text{Subjectivity} + \beta_7 \ast \text{Certainty} + \beta_8 \ast \text{Positive} + \beta_9 \ast \text{Negative} + \beta_{10} \ast \text{Uniqueness} + \beta_{11} \ast \log(\text{ElapsedTime}) + \beta_{12} \ast \log(\text{WordCount}) + \beta_{13} \ast \text{LaunchTime} + \beta_{14} \ast \text{Price} + \beta_{15} \ast \text{ReviewNum} + \xi + \lambda(z)
\]

### POTENTIAL CONTRIBUTION & CONCLUSION

The purpose of this research is to discover whether the presence of the product collective rating introduces biases or change the way people perceive information. We extend our knowledge of collective ratings from new perspectives – forming predisposition and risk perception of each product. We suggest that 1) review’s collective rating has a direct predisposition effect on consumers’ perception towards detailed review information, and 2) the collective information indirectly influences the helpfulness perception behavior of online consumers as its appearance portrays the risk level of product performance.

### Theoretical & Practical Implications

A main contribution of our study is to extend the current research of reviews helpfulness perception. We start from the perspective of collective rating information. Instead of proving positivity bias [36] and negativity bias [29][42], our results will provide evidence that predisposition influences review feedback perception, resulting that the consensus information is more likely to be favored. Since the two biases have received substantial discussion over the past decade, our work on the collective rating intends to supplement their research findings and help reconcile and explain the inconsistency.

The present research will also contribute to the knowledge of consumer perception towards word-of-mouth information. We suggest that, first, potential consumers tend to follow the collective evaluation before they make purchase decision. Second, our research will extend the role of perceived risk on adoption behavior of information technologies [38]. We propose that under a risky shopping situation, consumers are less willing to take words of consensus information and more acceptable to various types of information.

Additionally, our research will shed light upon online marketing practices. With the direct and indirect effects of collective evaluation, marketers or executives should think about how to apply them on their product pages. As lower ratings’ presence can suffer from both direct and indirect effects of collective rating, sellers should think of ways to minimize the disadvantages. Instead of offering aggregated information of rating, it is worth trying to separate the one rating into several dimensions, such as ratings on product appearance, duration, sellers’ service, package delivery and so on. Moreover, in order to make the most use of positive WOM, marketers or sellers should provide more security or safety cues to reduce the risk perception of...
potential consumers.

Limitation & Future Work
The emphasis of the present research is limited to the helpfulness perception of online consumers. However, future work could extend our idea on the adoption behaviors and the economic benefits of consensus or deviant WOM information. Also, in this study, we examine the moderation effect of performance risk on the relationship between WOM information and consumers’ perception. We acknowledge that other risk dimensions are left uninvestigated. Future research may address the problem by other risk facets and explore their impact on the consumers’ perception or behaviors towards information. In order to further generalize our idea, future research could also use multiple methodologies or apply to other contexts to investigate the idea of present study.

REFERENCES


THE PROFIT-SPLITTING MODEL IN THE SHARING ECONOMY
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Owen Wang, National Chengchi University, Taiwan, owen@acegroup.com.tw

ABSTRACT
In the sharing economics era, platform modes have become much more prevalent as information and communication technologies (ICT) have made it easier to build marketplaces for providing individuals, corporations, non-profits and governments with information that enables the optimization of resources through the redistribution, sharing and reuse of excess capacity in goods and services. There are many new organizations around us that practice the platform model, for instance, Airbnb and Uber. These organizations seem much more like associations of independent professionals and companies that connect to customers through a common platform. Furthermore, each association acts like a conglomeration in the ability of empowering its associated professionals and companies to deliver services independently while enforcing consistency in order to build its brand. Over the platform, there are a collaborative consumption phenomenon in which participants share access to products or services, rather than having individual ownership, and a common premise that when information about goods is shared (typically via an online marketplace), the value of those goods may increase for the business, for individuals, for the community and for society in general. In sum, the platform should embed with a profit splitting model that benefits all associated professionals and companies. This study use the new platform set up by the Tripbaa to explore the profit splitting model.

In brief, around the world, there are more than 0.1 billion Destinations Tourism that want (1) the pleasure of exploring the tourism destination, (2) the free, convenient, and instant travel, and (3) the share of travel inspiration. The Tripbaa tries to fill in the demand gap to become the top brand for Chinese Destinations Tourism around the world. To accomplish this, the Tripbaa sets up a platform that connects FIT to professional tour guides. The Tripbaa platform also provides a one-stop FIT service with customized itinerary, charter, accommodation, and so on. With a well-established platform, the Destinations Tourism tour arrangement is integrated into the smart tourism and becomes much easier. The Tripbaa platform also provides a profit splitting model that attracts all strategic partners, including professional tour guides, charters, accommodation providers, and travel agents.

Keywords: Information and communication technologies (ICT), destinations Tourism, free independent travelers (FIT) sharing economy, profit splitting model.
THE RISE OF THE MACHINES: ROBOTIS, A FRONTIER IN EDUCATIONAL AND INDUSTRIAL ROBOTS IN KOREA

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Jeehyun Ahn, College of Business Administration Seoul National University, jhhoney@snu.ac.kr
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ABSTRACT

Robot industry is quickly becoming one of the fastest growing markets in the world. Already used in various fields, robots are replacing more and more labors. The prospects for this industry is quite bright since many countries in the world are adopting programs and policies to develop the robot markets. In this paper, we will look into a Korean venture firm that is growing together with the robot industry: ROBOTIS. Beginning with the growth story of ROBOTIS, we will analyze the business environment the firm is facing. We will also look into the main products of ROBOTIS and how they correspond with the trend of the robot industry.

Keywords: Robotis, Industrial robots, Educational robots

INTRODUCTION

“Robots are beginning to augment and replace labor in a wide range of industries: a megatrend that is transforming the economics of manufacturing and reshaping the business landscape. Already used to fight wars, remove dangerous land mines, and fill customer orders…robots can perform quite a few of the jobs that humans currently do – often more efficiently and at a far lower cost” [9].

Sander et al. (2014) from the Boston Consulting Group prospected that robots are beginning to replace labor in a wide range of industries and this megatrend is transforming the economics of manufacturing and reshaping the business landscape. As a frontier in industrial and education robots in Korea, ROBOTIS (www.robotis.com) develops and produces robotic joints, controllers, sensors and other devices that are needed to control a robot. With the devices that it has developed, ROBOTIS has taken the lead in not only the industry of robotic actuators but also other field of contents stem from them, for instance, a set of educational humanoid. The very first step of the business has been taken as the founder’s philosophical concern “Robot is…” in action. The founding C.E.O. ByungSoo Kim himself was indeed a talented robotics mania ever since he has started his life in college. Majoring in Electrical Engineering, Kim has participated and won first prices in a number of competitions in robotics including International Event - Mobile Robot Contest in 1995, Japan Micro-mouse Competition in 1997, and many international robot soccer competitions.

The field of Robotics in South Korea has always been hopeless; it was lack of both demands and interests. Things weren’t so different in the early years of ROBOTIS. Despite the cutting edge skills and knowledge, it has hardly found the strategic plan of finding and meeting sufficient demands. What was different with ROBOTIS, however, was it has spotted its initial chance in rare field of applied robotics: the robotic toys. ROBOTIS has exported thousands of it products “DIDI & TITI” in the United States and Japan, and this instant success has provided it with another chance of taking a step of developing DYNAMIXEL, now known as the most famous actuator made by ROBOTIS.

The development of DYNAMIXEL has dragged the company into the professional field of robotics from the field of toys, while it continues to develop “educational robotic kits” on the top of its experience of producing toys. ROBOTIS has pioneered its unique position as a single company that develops and produces professional robotic actuators as well as educational products for children, and this synergic position let it launch higher level robots that children can intuitively deal with: Bioloid. Bioloid has proudly walked into newly created field of educational robotics for children, making an unexpected change. The founding C.E.O. ByungSoo Kim himself was indeed a talented robotics mania ever since he has started his life in college. Majoring in Electrical Engineering, Kim has participated and won first prices in a number of competitions in robotics including International Event - Mobile Robot Contest in 1995, Japan Micro-mouse Competition in 1997, and many international robot soccer competitions.

In early days of ROBOTIS, it has focused in developing hardwares as a product, but it is now targeting to handle related contents such as softwares and even robot-related services. ROBOTIS now introduces itself as a “Robotic Solution Company.” In this case study, with a frontier in robotics, ROBOTIS, we propose the current status and future prospects of robot industry in Korea.

GROWTH OF ROBOTIS

In his younger years, C.E.O. Kim has always preferred visiting a local market electronic components and creating things out of it than studying with books in college. Without the easily accessed web resources, the only way he could possibly learn and experience that are not available in college was either reading related articles or asking other who are capable of inform about them. Despite the difficulties, he passionately tried that he even spent most of the money he has made from tutoring high school students. Even after college, he has discarded an occupation in a decent corporation to kick off his dream of robotics.
After a few years of business, a college alumnus suggested to take the same boat. He is the current C.T.O. of ROBOTIS, HA In Yong. Their business has been funded by the start-up supporting program in Korea University, gave them the chance to proudly start business.

Since then, ROBOTIS has developed “DIDI and TITI,” a set of robotic toys (see Figure 1) that resemble mice that utilizes network to perform. It brought the company a great success as thousands of them were exported, suggested to take another step. The following step, however, was a step on a fall; their attempt to expend their occupation to production and marketing alongside with development returned them a great failure as the tremendous amount of components it has imported from China found to be useless. The company hardly maintained space for storing products and filed financial debt up to 2 billion Korean Won (approximately 18 million US Dollar). For years of harsh time, Kim has to spend most of his time to loan for worker’s salary, but in the end of hopeless times, he has perfectly cleared all the financial debt with the development DYNAMIXEL. Kim has mentioned that the field of Humanoid is known to be a frozen business with most difficult in technology, and he was sure that it is why ROBOTIS can possibly take the lead in the field. In an interview with etnews, Kim said, “DYNAMIXEL is being used in professional field in over 40 countries, and we are dreaming for another challenge with the possibility we have found in it.”

Figure 1. DIDI & TITI

PROSPECT OF ROBOT INDUSTRY

As shown in Figure 2, worldwide spending on robotics is expected to reach $67 billion by 2025 from just over $15 billion in 2010. The leading IT companies like Google and SoftBank are keep expanding their business to robot industry.
Ahn, Ahn & Oh

Figure 2. Worldwide Spending on Robotics

Note: UAV = unmanned aerial vehicle; UGV = unmanned ground vehicle; UUV = underwater vehicle. Estimates do not include the cost of engineering maintenance, training, or peripherals.
Source: [9]

Many countries of the world implemented various policies promoting robot technology to follow the megatrend. Barack Obama, the current president of the United States, launched the Advanced Manufacturing Partnership (AMP) that included investing in next-generation robotics in 2011. Japanese Prime Minister Shinzo Abe also addressed the OECD assembly in Paris in 2014 that Japan will spark a new industrial revolution based on robots. In addition, Xi Jinping, the president of China that rises as the world’s No.1 manufacturing robot market, highlighted that China will become the greatest robot power in the world. EU launched the SPARC, the partnership for robotics in Europe as well.

According to the International Federation of Robotics (IFR)’s “World Robotics 2014”, the world market of robot reached $14.8 billion in 2013 on the support of the US manufacturing’s returning to growth and the economic recovery of Europe as Table 1 [12].

Table 1. Trend of the World’s Robot Market Size

<table>
<thead>
<tr>
<th>Type</th>
<th>09’</th>
<th>10’</th>
<th>11’</th>
<th>12’</th>
<th>13’</th>
<th>13’/12’</th>
<th>Annual Avg</th>
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<tbody>
<tr>
<td>Manufacture</td>
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<td>5,678</td>
<td>8278</td>
<td>8496</td>
<td>9507</td>
<td>11.9%</td>
<td>24.3%</td>
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<td>4860</td>
<td>5282</td>
<td>8.7%</td>
<td>17%</td>
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<td>Profession</td>
<td>2,200</td>
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<td>3569</td>
<td>3569</td>
<td>3567</td>
<td>-1.9%</td>
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<td>Individual</td>
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<td>537</td>
<td>636</td>
<td>1224</td>
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<td>40.0%</td>
<td>30%</td>
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<td>6,777</td>
<td>9,568</td>
<td>12483</td>
<td>13356</td>
<td>14789</td>
<td>10.7%</td>
<td>21.5%</td>
</tr>
</tbody>
</table>

Source: [12]

Among the growth, the market size for service robot increased by 8.7% in 2013 compared with the previous year, from US$ 4.86 billion to US$ 5.28 billion. The service robot market has been built around medical robots for therapy, field robots for milking and stockbreeding, defense robots for unmanned aerial vehicle (UAV), mine detection, and clearance, and home robots for domestic tasks, but the growth of entertainment robot, home robot, and distribution robot stood out in 2013. The market size of entertainment robots increased by 73.9% compared to the size of 2012 (see Table 2).
Ahn, Ahn & Oh  

The Fifteenth International Conference on Electronic Business, Hong Kong, December 6-10, 2015

Table 2. Trend of Service Robot Market Size

(Unit: million USD, y-o-y, %)

<table>
<thead>
<tr>
<th>Types</th>
<th>2011</th>
<th>2012</th>
<th>Increase</th>
<th>2013</th>
<th>2014–17(e)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Amoun</td>
<td>Proportion</td>
<td>Amoun</td>
<td>Proportion</td>
<td>Increase</td>
</tr>
<tr>
<td>Field Robotics</td>
<td>879</td>
<td>22%</td>
<td>847</td>
<td>17%</td>
<td>-3.6</td>
</tr>
<tr>
<td>Logistic Systems</td>
<td>166</td>
<td>4%</td>
<td>196</td>
<td>4%</td>
<td>18.0</td>
</tr>
<tr>
<td>Medical Robotics</td>
<td>1,356</td>
<td>33%</td>
<td>1,499</td>
<td>31%</td>
<td>10.5</td>
</tr>
<tr>
<td>Defense Applications</td>
<td>748</td>
<td>18%</td>
<td>818</td>
<td>17%</td>
<td>9.4</td>
</tr>
<tr>
<td>Domestic Tasks</td>
<td>454</td>
<td>11%</td>
<td>697</td>
<td>14%</td>
<td>53.5</td>
</tr>
<tr>
<td>Entertainment Robots</td>
<td>166</td>
<td>4%</td>
<td>524</td>
<td>11%</td>
<td>215.6</td>
</tr>
<tr>
<td>Others</td>
<td>436</td>
<td>8%</td>
<td>279</td>
<td>6%</td>
<td>-36.0</td>
</tr>
<tr>
<td>Total</td>
<td>4,205</td>
<td>100%</td>
<td>4,860</td>
<td>100%</td>
<td>15.6</td>
</tr>
</tbody>
</table>

Source: [12]

The International Federation of Robotics (2014) forecasted that the size of US$ 30 billion market for service robot is expected to be formed from 2014 to 2017. As a big increasing trend of market for service robot is anticipated in the medium to longer term due to many countries’ service robot market creation and expansion, the markets for entertainment robots and defense robots, which ROBOTIS focuses on, are forecast to grow enormously. As shown in Table 3, the market for defense robot is expected to increase by about 12 times, and the market for service robot also is expected to increase by around 5 times by 2017, compared to the markets size in 2013.

Table 3. Expected Size of Service Robot Market

<table>
<thead>
<tr>
<th>Types</th>
<th>'12</th>
<th>'13</th>
<th>'14–'17(e)</th>
<th>$1,000</th>
<th>$ million</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service Robot(Total)</td>
<td>3,064,810</td>
<td>3,932,612</td>
<td>31,553,270</td>
<td>4,860,228</td>
<td>5,282,031</td>
</tr>
<tr>
<td>Professional Service</td>
<td>20,214</td>
<td>21,036</td>
<td>134,520</td>
<td>3,635,525</td>
<td>3,567,406</td>
</tr>
<tr>
<td>Field</td>
<td>5,043</td>
<td>5,921</td>
<td>33,850</td>
<td>846,585</td>
<td>882,849</td>
</tr>
<tr>
<td>Professional Cleaning</td>
<td>324</td>
<td>323</td>
<td>2,550</td>
<td>6,608</td>
<td>7,380</td>
</tr>
<tr>
<td>Exploration &amp; Maintenance</td>
<td>106</td>
<td>277</td>
<td>3,880</td>
<td>13,281</td>
<td>26,275</td>
</tr>
<tr>
<td>Construction &amp; Demolishing</td>
<td>472</td>
<td>690</td>
<td>2,720</td>
<td>33,875</td>
<td>42,731</td>
</tr>
<tr>
<td>Logistics System</td>
<td>1,376</td>
<td>1,889</td>
<td>10,250</td>
<td>196,091</td>
<td>219,674</td>
</tr>
<tr>
<td>Medical</td>
<td>1,214</td>
<td>1,286</td>
<td>7,180</td>
<td>1,449,052</td>
<td>1,449,479</td>
</tr>
<tr>
<td>Rescue &amp; Safety</td>
<td>78</td>
<td>105</td>
<td>1,140</td>
<td>24,224</td>
<td>22,342</td>
</tr>
<tr>
<td>Defense</td>
<td>10,327</td>
<td>9,520</td>
<td>54,050</td>
<td>818,304</td>
<td>791,982</td>
</tr>
<tr>
<td>Personal Service</td>
<td>3,044,596</td>
<td>3,911,576</td>
<td>31,418,750</td>
<td>1,224,703</td>
<td>1,714,623</td>
</tr>
<tr>
<td>Domestic Use</td>
<td>1,961,330</td>
<td>2,700,235</td>
<td>23,891,750</td>
<td>697,213</td>
<td>790,491</td>
</tr>
<tr>
<td>Entertainment</td>
<td>1,083,098</td>
<td>1,210,633</td>
<td>7,512,550</td>
<td>523,559</td>
<td>911,211</td>
</tr>
<tr>
<td>Elderly/Handicapped Aids</td>
<td>150</td>
<td>708</td>
<td>12,400</td>
<td>3,931</td>
<td>3,921</td>
</tr>
</tbody>
</table>

Source: [12]
MAJOR PRODUCTS OF ROBOTIS

The robot industry has a huge possibility to grow, and the service robot market ROBOTIS focuses on has a high potential as well. ROBOTIS offers educational kit such as ROBOTIS PLAY for students, and the smart actuator ‘DINAMIXEL’ which can be applied to various applications as it includes functions of motor, deceleraotor, controller, and communication. Table 4 shows the main products of ROBOTIS.

Table 4. Products lines of ROBOTIS

<table>
<thead>
<tr>
<th>Targeted Field</th>
<th>Image</th>
<th>Targeted Usage</th>
<th>Products</th>
</tr>
</thead>
<tbody>
<tr>
<td>Educational Robotic Kits</td>
<td></td>
<td>Mania</td>
<td>ROBOTIS STEM</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ROBOTIS BIOLOID</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ROBOTIS GP</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Beginners</td>
<td>ROBOTIS IDEAS</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ROBOTIS PLAY</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ROBOTIS SMART</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Actuator</td>
<td>DYNAMIXEL</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>DYNAMIXEL PRO</td>
</tr>
<tr>
<td>Modulated Product</td>
<td></td>
<td>Research</td>
<td>3-finger Hand</td>
</tr>
<tr>
<td>Platform</td>
<td></td>
<td>Individual and Research</td>
<td>DarwIn-OP</td>
</tr>
<tr>
<td>Etc</td>
<td></td>
<td>Robot Accessories and Mobile Solutions</td>
<td></td>
</tr>
</tbody>
</table>

Source: ROBOTIS website

**Educational robotics kits**

In 2000, there has been a rapid grow in research field of Robotics, specifically in US, Japan, and South Korea. The recent sparking achievements in research in not only the Robotics but also other fields of Engineering has brought about a focused interest of the society as the future strategy of the nations, and this has spot-lighted a need of education of potential future Robotic Engineers, the Children. To meet the demand, ROBOTIS started to seek to develop very intuitive robotic kits so any children interested in any kinds of robots can play with them.

In 2009, ROBOTIS has launched a new line of products, and it has named it “OLLO.” Meaning “All + Robot,” its primary goal is not only letting children to play with them, but also to develop their creativity, scientifically thinking strategy, and interest in Robotics. With such catchy tools, ROBOTIS has been looking forward the children to acquire self-learning skills in Mathematics and Science from the experience scientific system in the educational robots.

The core of OLLO is the farthest “Intuitiveness,” and “Degrees of Freedom.” Children can easily build a robot in their need without heavy tools, while the range of resulting system is not restricted in any kind of manuals; with the sensors, motors, and plastic tools that are mechanically engineered that are provided and sold separately, they bring children’s imagination to endless. Today, ROBOTIS officially changed the name of OLLO to ROBOTIS DREAM.
Other than OLLO, ROBOTIS has introduced higher-level educational robotic kits that utilizes more and higher level sensors and actuators. Recently launched ROBOTIS Smart is getting more and more interests from children and their parents with the involvement of smart phones.

![ROBOTIS IDEAS](image1)

![ROBOTIS SMART](image2)

![ROBOTIS STEM](image3)

![ROBOTIS PREMIUM](image4)

Source: ROBOTIS Website

**Actuators**

C.E.O. Kim has mentioned that he has started the business with the disappointment with the lack of performances of the actuators in public markets back in the years he has participated in a number of competitions in Robotics. ROBOTIS has sought to solve such problems as it develops a better actuator for robot manipulation, end up introducing DYNAMIXEL at glance. DYNAMXEL, a modulated actuator, has essential electrical and mechanical systems, such as a motor driver and reduction gears, integrated alongside with a electrical motor. Many robotics researchers and hobbyists have found convenient to build a robotic systems with sufficient performance, and such response from the market firmly positioned the company in professional actuator industry.

In an effort to take a further step into a professional robotics actuator industry, ROBOTIS has introduced a new line of DYNAMIXEL called “DYNAMIXEL PRO.” While these costs far more than conventional ones, DYNAMIXEL PROs exhibits better performances by far; with much higher resolutions of rotation with higher powered motors and reduction gears with much higher reduction ratio, ROBOTIS is targeting to meet further demands of professional researchers in larger scale institutions and laboratories. While there have already been existing high-powered actuators in the industry, what makes DYNAMIXEL PRO different from others is that it has the modular structure of conventional DYNAMIXEL integrated that makes a build a lot more simpler. Such convenience is always welcomed by researchers and developers because conventional systems are complicatedly structured with actuators which make not only the design and build but also part replacement very hard.

ROBOTIS is taking its effort to prove the coincidence of the convenience and performance of its product as it develops a full-sized humanoid using DYNAMIXELs only, mostly DYNAMXIEL Pros. The humanoid, called “THOR-MANG” is performing in DARPA Robotics Challenge.

**FUTURE OF ROBOTIS**

ROBOTIS is taking a challenge in DARPA Robotics Challenge. Hosted by DARPA, Defense Advanced Research Projects Agency in the US, DRC is a huge scaled robotic competition aiming for the development robots that can substitute humans when needed. Citing DRC website, “The DRC is a competition of robot systems and software teams vying to develop robots capable of assisting humans in responding to natural and man-made disasters.” Participating robots are given eight missions that are likely happen in real disaster site like Fukushima Nuclear Plant explosion, and these includes driving a car, closing valves, drilling a wall, and opening human-oriented doors. In last trial, the full-sized humanoid THOR-MANG by ROBOTIS has ranked the 9th among all participants. In the upcoming final DRC, a new team from South Korea, team SNU from Seoul
National University, is also participating with a revised version of THOR-MANG.

![Figure 7. THOR-OP (left) and THOR-MANG (right)](source: DARPA ROBOTICS CHALLENGE website)

**CONCLUSION**

Many countries all over the world including Japan, the U.S., China and Korea, are already investing in the robot industry. Considering the increasing demands, the future of robot industry is very promising, and ROBOTIS seems to fit the current trends of robot industry. ROBOTIS’ educational kit has been selected as teaching kits for the duty training of robot teachers. Their DINAMIXEL has been exported to more than 40 countries since the release, and 39 teams out of 40 installed the ROBOTIS’ DINAMIXEL during RoboCup (Robot World Cup) in 2014. And now, two robots with the DINAMIXEL are participating in DARPA challenge.

ROBOTIS seemingly never stays in their current success, yet always takes another chance with great enthusiasm. This is why a greater and brighter future is expected with ROBOTIS.

**REFERENCES**

[6] Park, J. (2013) Byungsoo Kim, 'Robotic CEO 'It is not just a seeking for fun without a marketability'.
THE ROLE OF CONTEXTUAL FACTORS IN ONLINE PRIVACY DECISION
Dong-Joo Lee, Hansung University, South Korea, djlee@hansung.ac.kr
Youngsok Bang, The Chinese University of Hong Kong, China, bangyoungsok@baf.cuhk.edu.hk

ABSTRACT
Innovation in information and communication technologies has enabled firms to collect information about individual customers and to use the information to understand their preferences at substantially low costs. Based on this understanding, firms can provide the customers with improved value such as products that fit best with individual customer needs. This ability is further enhanced by the rapid penetration of mobile devices, which are personal in nature. However, the collection and use of private information have caused widespread apprehension by consumers that their privacy is invaded. It has been well established that privacy risk is greater for more sensitive personal information and thus people are likely to refuse to provide sensitive information correctly. The main objective of this study is to explore moderating factors that influence the negative effect of information sensitivity on personal information disclosure. Specifically, this study focuses on two contextual factors in privacy decision, including the relevance of information and the intrinsic value of transaction, and investigates how the factors can change the impacts that information sensitivity has on the disclosure of personal information. A central finding of an online experiment employing two scenarios of personal information disclosure is that disclosure of sensitive information is responsive to the contextual factors in such a way that the negative impact of information sensitivity can be attenuated by the contextual factors. This study contributes to understanding of online users’ privacy decision by suggesting the interplay between an inherent attribute of information (i.e., information sensitivity) and contextual factors in formulating users’ privacy decision.

Keywords: Privacy decision, information sensitivity, information relevance, intrinsic value of transaction

INTRODUCTION
Innovation in information and communication technologies offers firms great opportunities to build new relationships with customers and to treat different customers differently. These technologies enable firms to collect information about individual customers and to use the information to understand their preferences at substantially low costs [16]. Based on this understanding, a firm can improve its value proposition for consumers, enhance their loyalty to the firm, and increase the operational efficiency and profitability [17] [19]. This ability is further enhanced by the rapid penetration of mobile devices, which are personal in nature. This strategic importance and enhanced technological capabilities have made effective collection and use of personal information an imperative for competitive advantage.

However, the collection and use of private information have caused widespread concerns by consumers that their privacy is invaded. Recent growth of social networking services and progress in cloud computing technologies and services have further increased consumers’ privacy risk perception. Faced with the concerns, consumers usually make decisions about personal information disclosure based on “privacy calculus”—an assessment of the costs and benefits related to information disclosure [3] [5] [11]. Therefore, it is a critical challenge for firms to reduce consumers’ privacy risk related to their personal information disclosure.

Accordingly, a lot of research effort has been made to investigate factors that influence Internet users’ privacy decisions regarding personal information disclosure. Previous empirical literature on information privacy has identified various determinants including personal characteristics (e.g., information privacy concerns, privacy intrusion experience, demographics, etc.), institutional factors (e.g., privacy statements, privacy seals, privacy regulation, etc.), and contextual factors (e.g., benefits from information provision such as personalization or rewards, attributes of information, etc.) [1] [3] [5] [13] [21] [25].

It is widely accepted that users perceive a higher level of risk when they disclosure more sensitive personal information [10] [13] [18]. As such, the sensitivity of information has been a focal information attribute that has drawn a lot of research effort. The main objective of this study is to explore moderating factors that influence the negative effect of information sensitivity on personal information disclosure. Specifically, this study focuses on two contextual factors in privacy decision, the relevance of information and the intrinsic value of transaction, and investigates how the factors can change the impacts that information sensitivity has on the disclosure of personal information.

While information relevance has been proposed as an antecedent in privacy decisions [22], there exists little empirical research on the impact of information relevance. This study contributes to the privacy literature by suggesting the relevance as another critical attribute of information to be considered in privacy research and by investigating empirically the impact of relevance in personal information disclosure.

Based on the privacy calculus perspective, researchers have tried to examine the effect of rewards offered in return for information disclosure [8] [25]. Although the reward can be a benefit factor in the calculus, it is essentially extrinsic in that it is not related to the user’s purpose of interactions with a firm. This study contributes to deeper understanding of the role of the intrinsic value by examining its interaction with information sensitivity in formulating privacy decisions.
THEORETICAL BACKGROUND AND HYPOTHESES

Attributes of Information and Privacy Decision

Various types of information are collected online including demographics, lifestyle information, shopping history and habits, financial information, and personally identifiable information such as names and social security numbers [7][9][16]. Attributes of the information may affect users’ information disclosure behaviors in the course of their interactions with firms [2][18][20][23][24]. In this study, we consider two important attributes of information—sensitivity of information and relevance of information—that may influence privacy decision regarding the information.

Information sensitivity refers to the degree of discomfort an individual perceives in providing specific information to a firm [12]. In general, different pieces of information are related to different levels of sensitivity, and consumers perceive a higher level of risk when they disclose more sensitive information [15]. Therefore, from the perspective of privacy calculus, the sensitivity of information would negatively affect personal information disclosure.

The relevance of information refers to the degree to which the information requested appears relevant to the purpose of transactions with the firm [22]. This definition implies that the relevance of information is not an inherent attribute of specific pieces of information but a context-dependent attribute. Consumers’ privacy decisions over the same piece of information may be different depending on the context of the decision. For example, when a consumer purchases a physical product from an Internet site, she would provide her address correctly to the site because the product should be delivered to her home, that is, the address is relevant information. On the other hand, if she buys a digital good (e.g., a music file) from the site, she might not be willing to provide her address because the file is delivered via the Internet and the address is not relevant to the transaction. For relevant information, a consumer would perceive that she could effectively achieve her purpose of transaction with the firm by providing the information. However, providing irrelevant information would just incur consumers’ perceived risks without contributing to the achievement of the goals. Therefore, the relevance of information would have a positive effect on personal information disclosure.

While the negative impact of information sensitivity has been widely accepted, some empirical studies have found that the impact is not significant [8][12]. This result implies a potential interaction effect between the sensitivity and relevance of information. For example, some personal information may be indispensable for fulfilling e-commerce transactions. Then, users may be willing to provide sensitive information such as credit card numbers or cellphone numbers when it is highly relevant. Therefore, we suggest that the negative effect of sensitivity is strong when the requested information has a low level of relevance while the effect is reduced for information with a high level of relevance.

H1: Information relevance reduces the negative effect of information sensitivity on personal information disclosure.

Intrinsic Value and Privacy Decision

The privacy calculus literature suggests that personal information disclosure is an increasing function of the user’s benefit expected from the disclosure. Based on the reasoning, many empirical studies have examined the effect of rewards for information disclosure (e.g., [8][25]). However, the rewards are essentially extrinsic in that they are not related with the user’s purpose of interactions with a firm. In this study, we examine a user benefit factors that is intrinsic to user–firm interactions, the value users expect from the firm’s product or service. The intrinsic value will be considered in the user’s privacy calculus as a benefit factor of information disclosure, which, in turn, will facilitate disclosure of personal information.

A high level of transaction value from a firm is likely to increase the consumer’s trust in the firm. Further, trust promotes risk-taking behaviors [14]. Thus, when intrinsic values are high, it is more likely that consumers are involved in risk-taking behaviors in their privacy calculus, that is, providing firms with sensitive information. Accordingly, intrinsic values are expected to moderate the effect of information sensitivity on personal information disclosure.

H2: Intrinsic value reduces the negative effect of information sensitivity on personal information disclosure.

RESEARCH METHODS

To test the hypotheses, we conducted a scenario-based online survey concerning hypothetical privacy decisions. As contexts of the decisions, we selected two real online services that operate in Korea. One is a part time job matching service and the other is an online dating service. Both matching services are similar in that they are targeting young people and based on the personal information users provide on the service sites. However, the two were different in the level of awareness at the time of the survey. The job matching service was well established while the dating service was newly launched. Therefore, the research design enabled us to examine possible difference of the effects depending on the level of awareness of the service. Participants were asked to suppose that they were considering the services and to decide whether to provide each information item requested by the firms.

The information items were selected through a separate online survey. We first reviewed the information items requested in the
two service sites and came up with thirty items after adding additional items. Then, we recruited business school students enrolling a university to rate the sensitivity and relevance of the information items. Forty-five students participated in the survey. When each respondent accessed the survey site, she was asked to rate the sensitivity of each of twenty items randomly chosen out of the thirty items (“Please rate the degree of discomfort you perceive in providing the information to a firm online.”). Then, after reading a description of one of the two matching services, she was asked to rate the relevance for each of randomly chosen twenty items (“Please rate the degree to which the information requested appears relevant to the purpose of transactions with the firm.”). Finally, the same procedure was repeated for the other service. A rating scale from 0 to 100 was used for all questions.

The sensitivity and relevance scores were averaged for each item. The averages for sensitivity ranged from 22.2 (favorite music genre) to 90.5 (bank account number) with a mean value of 53.3. The averages of the relevance scores for the job matching service ranged from 12.4 (bank account number) to 84.6 (highest level of education completed) with a mean of 41.9. The dating service had a similar range of 14.2 (bank account number) to 82.5 (age) with a higher mean value of 55.0. Based on the averages, we selected twenty items for each service that constitute four distinct groups in their levels of sensitivity and relevance, that is, Group_HH (high sensitivity and high relevance), Group_HL (high sensitivity and low relevance), Group_LL (low sensitivity and low relevance), and Group_LH (low sensitivity and high relevance). While some information items were common for the two services, the others were not. Each group included five information items. The mean values are summarized in Table 1.

<p>| Table 1. Mean Values of the Average Sensitivity and Relevance Scores |
|-----------------------------|------------------|-----------------|-----------------|------------------|</p>
<table>
<thead>
<tr>
<th></th>
<th>Group_HH</th>
<th>Group_HL</th>
<th>Group_LH</th>
<th>Group_LL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Job matching service</td>
<td>Sensitivity</td>
<td>69.2</td>
<td>72.6</td>
<td>35.4</td>
</tr>
<tr>
<td></td>
<td>Relevance</td>
<td>63.7</td>
<td>21.6</td>
<td>63.8</td>
</tr>
<tr>
<td>Online dating service</td>
<td>Sensitivity</td>
<td>70.4</td>
<td>75.2</td>
<td>38.2</td>
</tr>
<tr>
<td></td>
<td>Relevance</td>
<td>67.7</td>
<td>32.5</td>
<td>74.8</td>
</tr>
</tbody>
</table>

As the main survey respondents, we recruited business school students from two universities other than in the above survey. Participants were randomly assigned to one of the two service contexts. After reading the description of the assigned service, each participant was asked to suppose that she was considering the services and to decide for each of the requested item whether to provide the information correctly (1), provide it incorrectly (2), or not provide it at all (3). Figure 1 shows a screenshot.

The dependent variable of this study (disclosure of personal information) was measured with the proportion of correct disclosure for each of the four groups, that is, the number of 1’s divided by 5. Thus, each respondent has four values of the dependent variable, one for each combination of sensitivity and relevance.

![Figure 1. Screenshot of the Survey System (Translated in English)](image)

Then, the respondent was asked to answer her willingness-to-pay for the service to measure the value of the service she perceived. Additionally, her previous knowledge of the service was also measured using a binary scale to measure the awareness. Finally, gender and age were asked.

Table 2 summarizes descriptive statistics of the two sub-samples assigned for the two services. The number of the respondents for each service was ninety-two, thus, one hundred eighty-four in total. There were no significant differences in gender and age between the sub-samples. Eighty-eight respondents (95.7%) were aware of the job matching service while only seven respondents (7.6%) were aware of the online dating service, which was consistent with our expectation. The willingness-to-pay was greater for
the dating service \( (p < 0.05) \). In the analysis, the log of the willingness-to-pay was used as a measure of the value.

### Table 2. Sample Composition and Descriptive Statistics

<table>
<thead>
<tr>
<th></th>
<th>Job matching service sub-sample</th>
<th>Online dating service sub-sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size (persons)</td>
<td>92</td>
<td>92</td>
</tr>
<tr>
<td>Gender (persons)</td>
<td>Male 47 (51.1%) Female 45 (48.9%)</td>
<td>Male 51 (55.4%) Female 41 (44.6%)</td>
</tr>
<tr>
<td>Age (years)</td>
<td>Mean 22.4, St. Dev. 2.4</td>
<td>Mean 22.2, St. Dev. 2.4</td>
</tr>
<tr>
<td>Awareness of the service (persons)</td>
<td>Aware 88 (95.7%) Do not aware 4 (4.3%)</td>
<td>Aware 7 (7.6%) Do not aware 85 (92.4%)</td>
</tr>
<tr>
<td>Willingness-to-pay (Korean Wons)</td>
<td>Mean 3,464.2, St. Dev. 4,994.4</td>
<td>Mean 8,248.2, St. Dev. 13,451.6</td>
</tr>
<tr>
<td>Ln(Willingness-to-pay)</td>
<td>Mean 5.4, St. Dev. 3.8</td>
<td>Mean 6.4, St. Dev. 4.0</td>
</tr>
</tbody>
</table>

### ANALYSIS RESULTS

Our study design includes two within-factors (sensitivity and relevance) each with two levels (high vs. low) for a randomly assigned service. So, it corresponds to a \( 2 \times 2 \) repeated measure design, and a repeated measure ANOVA is applied for the analysis, where \( \ln(\text{willingness-to-pay}) \) is mean-centered. Table 3 summarizes the results.

From Table 3, the interaction term between sensitivity and relevance is significant for both services \( (p < 0.001) \). The effect of information sensitivity is found significant for both job matching and dating services \( (p < 0.001) \). The relevance of information also has a significant effect on personal information disclosure for both services \( (p < 0.001) \). Figure 2 shows estimated marginal means for the sensitivity-relevance combinations. An examination of the pattern of the interaction reveals that when the relevance of information is high, the negative impact of the sensitivity of information is reduced, supporting H1.

### Table 3. Results of Repeated Measure ANOVA

<table>
<thead>
<tr>
<th>Source</th>
<th>Job matching sub-sample</th>
<th>Online dating sub-sample</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( F )-value (( p )-value)</td>
<td>( F )-value (( p )-value)</td>
</tr>
<tr>
<td>Within</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sensitivity</td>
<td>31.95 ((&lt; 0.001))</td>
<td>459.59 ((&lt; 0.001))</td>
</tr>
<tr>
<td>Relevance</td>
<td>167.52 ((&lt; 0.001))</td>
<td>77.34 ((&lt; 0.001))</td>
</tr>
<tr>
<td>Sensitivity ( \times ) Relevance</td>
<td>16.11 ((&lt; 0.001))</td>
<td>39.26 ((&lt; 0.001))</td>
</tr>
<tr>
<td>Sensitivity ( \times ) Ln(Willingness-to-pay)</td>
<td>0.21 (0.651)</td>
<td>4.87 (0.028)</td>
</tr>
<tr>
<td>Between</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ln(Willingness-to-pay)</td>
<td>2.16 (0.145)</td>
<td>0.60 (0.442)</td>
</tr>
</tbody>
</table>

No. of observations: 368
R-squared: 0.6270 for Job matching, 0.7762 for Online dating
Adj. R-squared: 0.4968 for Job matching, 0.6980 for Online dating

![Figure 2. Estimated Marginal Means](image)

Next, let’s consider the simple effect of sensitivity. From Figure 2, one can find that sensitivity tends to decrease the proportion of correct disclosure. For the job matching service in the left panel, when relevance is low, the marginal mean for low sensitivity (0.6282) is significantly higher \( (p < 0.05) \) than that for high sensitivity (0.4174). However, there is no significant difference when
relevance is high (0.8217 vs. 0.7848). For the online dating service in the right panel, the sensitivity of information significantly reduces personal information disclosure regardless of the level of relevance (0.8261 vs. 0.2804 under low relevance, and 0.8761 vs. 0.5783 under high relevance).

Figure 2 shows that relevance tends to increase the proportion of correct disclosure. For the job matching service, the relevance of information significantly increases personal information disclosure regardless of the level of sensitivity (0.8217 vs. 0.6283 under low sensitivity, and 0.7848 vs. 0.4174 under high sensitivity). For the online dating service, while there is no significant difference when sensitivity is low (0.8761 for high relevance vs. 0.8261 for low relevance), the marginal mean for high relevance (0.5783) is significantly higher than that for low relevance (0.2804).

In Table 3, the interaction term between sensitivity and willingness-to-pay is insignificant for the job matching service. However, it is significant for the online dating service ($p < 0.05$). The estimated derivative of proportion of correct disclosure with respect to ln(willingness-to-pay) is larger for high sensitivity (0.0289) than that for low sensitivity (0.0181), which suggests a positive interaction effect. Thus, H2 is partially supported.

**DISCUSSIONS AND CONCLUSIONS**

In this study, we investigated the role of contextual factors in the Internet users’ privacy decision. We considered two attributes of information, the sensitivity and relevance of information, and the intrinsic value of transactions. We conceptualized information sensitivity as an inherent attribute of specific pieces of information which does not depend on the context of information disclosure. On the other hand, information relevance was conceptualized as a contextual attribute of information rather than an inherent attribute. Based on this conceptualization, we examined the impacts of the two contextual factors (information relevance and intrinsic value of transactions) in facilitating disclosure of sensitivity information.

The research hypotheses were tested using data from a scenario-based online experiment concerning hypothetical privacy decisions in the contexts of two online services. Overall, the analysis results support the positive interaction effects between information sensitivity and the contextual factors, indicating that information relevance and value of transactions reduce the negative impact of information sensitivity on personal information disclosure.

The current study has several implications. First, this study contributes to online privacy research by suggesting an important attribute of information, the relevance of information, and empirically investigating its effect in the privacy decision. While information sensitivity has been a well-established information attribute which hinders personal information disclosure, information relevance has drawn little research attention. The results show that information relevance can be a critical factor in the privacy decision in that it facilitates disclosure of sensitive personal information by limiting the impact of information sensitivity.

Second, this study suggests that intrinsic value should be one of main constructs in the privacy calculus model. While it has been conceptualized as a key benefit component in the privacy calculus (Culnan and Bies, 2003), previous empirical studies have mostly considered extrinsic benefit components such as monetary rewards, which are costly in nature. Privacy calculus literature has been based on an implicit assumption that benefits and costs are independent of each other in the calculus, and thus a natural conclusion is that the relative magnitude of benefit and cost determines the privacy decision (Awad and Krishnan, 2006). However, our results indicate that benefit and cost should not be considered independently; rather, it may be crucial to understand the interplay between them in understanding the privacy decision.

Third, from the managerial perspective, this study implies that online firms need to effectively communicate with the user the relevance of information they request and the intrinsic value the user could expect in return for the information. In this regard, explanation could be an important measure to influence the user perception of the relevance and value. Explanations offered by an information system can contribute to users’ understanding of how the system works and make the performance of a system transparent to its users (Gregor and Benbasat, 1999; Ye and Johnson, 1995). The role of explanations would not only be of interest to managers, but also be an important venue for future privacy research.

Although this study offers significant implications, there is a need for future research involving various online contexts of information disclosure. Further, scenario-based empirical studies, which have been frequently employed in the privacy literature (e.g., Malhotra et al., 2004), may be subject to insufficient validity compared to those based on information disclosure behaviors, which is another venue for future research.

**ACKNOWLEDGEMENT**

This research was financially supported by Hansung University.

**REFERENCES**


*The Fifteenth International Conference on Electronic Business, Hong Kong, December 6-10, 2015*
THE STUDY OF ORDER DECISIONS UNDER INDIRECT SELLING MODEL OF AN ELECTRONIC COMPONENT DISTRIBUTOR—TAKING ABC COMPANY AS AN EXAMPLE.

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ABSTRACT

Electronic component distributors play a mediate role in the electronic component industry. They need to coordinate upstream suppliers and downstream customers to decrease the gap of market demand and supply. ABC company, a leading electronic component distributor in Asia, plays a role of distribution among companies and be a buffer for its supply chain members.

ABC company has two different selling models: indirect and direct. The difference between them is the actors involved in the order management process. The former one has two essential actors: sales and product managers. Sales need to carry the duty of selling the product, and product managers are responsible for the order fulfillment. The later one only has product managers who handle every affair related to selling and ordering. Under the indirect selling model, sales need to get the order requests approved by product managers. The conflicts may occur while the order requests are rejected. The reason is due to that sales tend to sell products as more as possible to attain the targeted amount whereas product managers might concern the increased stock ratio from obsolete or surplus goods.

This situation is common in order fulfillment problems. In general, firms should consider the fulfillment budget in determining how much is acceptable to spend on fulfilling the order such as extra shipping cost, and the sales would usually adapt the “sell what you have” policy which they are encouraged to sell products avoiding the extra stocks generated (Keely L., 2003).

In this paper, we would like to understand how order decisions are made in an electronic component distributor company under indirect selling model. We would like to identify its ordering process and further examine its effectiveness in terms of reaching high ordering fulfillment rate and low inventory level.

This study will take case approach as the primary researching method. Through interviews with product managers and sales in the case company, we expect to obtain the knowledge regarding with ordering processes and different fulfillment policies under indirect selling model.

Keywords: Order fulfillment, Inventory, Demand forecasting, Electronic component distributors.

REFERENCES

THE TEACHING CASE FOR PRODUCT MANAGEMENT IN THE ELECTRONIC COMPONENT INDUSTRY - USING COMPANY WAS A CASE STUDY.

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ABSTRACT

Company W is one of the biggest Electronic Component Distributors in Taiwan. In the electronic component industry, W company plays a buffer role between upstream and downstream companies. It coordinates order quantity and production time. In addition, it can also reduce loss caused by uncertain situations like urgent or rescheduling orders. While an electronic component distributor may face many uncertain situations, product managers in the company face tremendous challenges in making ordering decisions. Currently, product managers in the W company only depend on their experience and intuition to make choices. In other words, W company does not have a clear rule or method to educate their product managers. According to Harvard Business Publishing (2015), “using case method teaching can let students enjoy the lively, participatory nature of an approach that enables them to play an active role in the learning process.” Thus, W company collaborates with us to design a teaching case for their product managers.

Roberts, M. J. (2001) pointed out some tips for writing a good case. In addition to prepare an outline, it is important to use a time line for understand the logical relationships between events. Simulation can easily be built in case by means of spreadsheet or data, which is available over the web as “courseware”. Analysis of financial data is often helpful to make available in spreadsheet. There are many teaching cases on Harvard Business Pub.. Gourville, J. T. (2011) made a pricing simulation software to simulate rental car agency. Students can check the dashboard to overview several cities’ market share and set each price to maximize inventory and profit. For every pricing decision, students must consider competitive reactions. Instructors can help students using varied scenarios to experience different pricing challenges. Other teaching cases like Hammond, J. H. (1994) extended beer game to a board version that made it easier to understand how supply chains work. Frei, F. X., & Shapiro, R. D. (2009) used some simulation models teaching in executive education programs. Students can increase their intuition and understand core operation concepts via group discussing. Mollick, E. (2014) has developed simulation for students to learn starting a new company. While incorporating simulation and games into teaching case is helpful for students to understand difficult concepts, rules and theories, we aim to use this approach to design our teaching case for students to understand how to determine order amount and time in an uncertain environment.

We started this research in July, 2015. Our research plan will go through one year and be divided into three stages. First, we will conduct interviews with product managers in W companies. In this stage, our goal is to identify questions for students and prepare potential answers. Second, we will incorporate the questions and answers into a simulation or game. We will invite employees to test the simulation model and refine it. At the last stage, we will prepare teaching tutorial to illustrate the theories and concepts behind the simulation model and the teaching goals of this case. We expect this research will deliver three outputs:
1. The implicit knowledge about ordering amount and time extracted from from product managers.
2. A case with simulation and gaming design.
3. A teaching tutorial that illustrates how to use the case to educate product managers.

Keyword: Teaching case, simulation, electronic component industry, product management.

Reference

UNDERSTANDING COMPETING APPLICATION USAGE BY INTEGRATING INFORMATION SYSTEM SUCCESS MODEL AND NETWORK EXTERNALITY THEORY

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ABSTRACT

The D&M IS Success Model has been widely applied to evaluate the information system success model. Since the connections and communications among individuals tend to be closer, this study introduces network externalities to the existing model. In addition, although previous studies view the information quality, system quality and service quality as independent variables without interactions, this research investigates the inter-relationships among them. Since there are so many applications with same functions in the competitive market, in this study we also try to understand competing application usage by integrating IS success model to see how individuals make a decision to select one from two choices, and analyze the theory in the relative evaluation by applying comparison by difference (e.g., “user’s satisfaction towards A” minus “user’s satisfaction towards B”). The result shows that network externalities have a great impact on the individual's decision making, and its effect on service quality actually exerts by the mediating effects of information quality and system quality. The service quality was also proved to be affected positively by information quality and system quality. Thus, the current study not only contributes to the current theory by extending the model, but also provides some practical implications.

Keywords: IS Success Model, network externalities, service quality, competing application usage

INTRODUCTION

For many years, the D&M IS Success Model has been widely used to measure the complex dependent variables in information systems and also evaluate the success of an information system. The D&M IS Success Model tends to be increasingly rich by researches that focus on many independent variables influencing the IS success, for instance, trust, user expectations, extrinsic motivation, IT infrastructure and task compatibility, etc [21]. Apparently, in our times, people communicate mutually easier and more frequent, and their action of using an IS can also be easily influenced by others. Therefore, we introduced the network externalities into the D&M IS Success Model, testing whether it puts effects on IS success, and if it does, how it works.

Moreover, researchers have long recognized that the three dimensions of quality, i.e., information quality, system quality and service quality have parallel effects on user satisfaction and use, but there is little research on the inner relationship of these qualities [34]. Several researches suggested that there are mediating interactions among the three types of quality [9]. Considering the prevalence of high technology, narrowing the gap of information quality among information providers and the gap of system quality among system operators, service quality is becoming more and more tangible for IS users and important for IS users as well as system owners and sponsors. Therefore, joint effects of system quality, information quality and service quality desire more attention.

Furthermore, as said before, in the competitive market, given that there are many information system with similar functions are available, such as operating systems (e.g., Linux, MacOS, and Microsoft Windows) and office software packages (e.g., Microsoft Office, StarOffice and IBM SmartSuite). Thus compared research that examines more than one similar information system is tends to be an interesting and significant topic to study which application would be chosen by individuals and what would affect them to select one from various choices. However, according to the prior IS success literature, studies have not shaded light on the issue of product selection. Therefore, in order to fill this gap, in this research, we choose WeChat official account and a mobile application, both providing weather forecast and related information (e.g., UV, the air quality and even advice on dressing) and service (e.g., share to SNS) as alternatives. Based on this context, the study examined the following features of the alternative: network externalities, information quality, system quality, service quality, user satisfaction and use. We conduct a special measurement of questionnaire by requiring subjects to answer each question for WeChat official account and mobile application respectively. Thus, when answering the questionnaires regarding the features and satisfaction of one information system, these subjects may compare their evaluations with the alternative. In this way, we suppose that the results would be more valuable and trustworthy. In fact, researchers in the field of psychology and marketing have widely acknowledged this issue [7] [25] [33].

THEORETICAL BACKGROUND

IS Success Model

DeLone and McLean Information Systems Success Model (Figure 1) was first proposed by DeLone and McLean in 1992 which is based on theoretical and empirical IS research conducted by researchers in the 1970s and 1980s, being used as a model for measuring the complex dependent variable in information system research [8].
While with sequent researches, for instance Shannon and Weaver [24] and the information “influence” theory of Mason [20], the original IS Success Model was then updated by DeLone and McLean themselves in 2003 (Figure 2).

In the updated IS Success Model, three dimensions of quality are measured or controlled separately to affect the subsequent “use” and “user satisfaction”, namely “information quality”, “system quality” and “service quality”. In the D&M IS Success Model, “systems quality” measures technical success; “information quality” measures semantic success; and “service quality”, added in 2003 measures whether the service providing for users is success (e.g., tangible, responsible, and reliable). According to DeLone and McLean [8], “use” and “user satisfaction” are closely interrelated. “Use” must precede “user satisfaction” in a process sense, but positive experience with “use” will lead to greater “user satisfaction” in a causal sense. Similarly, increased “user satisfaction” will lead to increased “intention to use,” and thus “use.” Subsequently, “net benefits” from the perspective of the owner or sponsor of the system will be influenced by “user satisfaction” and “use”, also, this “net benefits” will reinforce the future “use” and “user satisfaction” in return if the IS or service is to be continued.

DeLone and Mclean suggested that context plays an important role in evaluating the success. While measuring the success of a single system, “information quality” or “system quality” might be the most important quality component. Since these qualities are more measurable than service quality for individuals. However, for measuring the overall success of the IS department, as opposed to individual systems, “service quality” may become the most important variable.

Later, there are some researchers identified specific variables posited to influence the different dimensions of IS success. Petter et al. (2013),organize these success factors into five categories based on the Leavitt Diamond of Organizational Change(Leavitt, 1965): task characteristics, user characteristics, social characteristics, project characteristics, and organizational characteristics. Success factors such as trust, user expectations, extrinsic motivation, IT infrastructure, task compatibility, task difficulty, attitudes toward technology, user involvement, and relationship with developers have been found to influence IS success[21].
Network Externalities

Network externalities was defined as “the utility that a user derived from his/her consumption of a good would increase with the number of other users consuming this good” [15]. Once the scale of users reaches a considerable number, external benefit emerges and more users would be attracted to join [17]. Network externalities have been widely applied to explain the adoption of information system technology, especially for those computer-mediated communication applications. For instance, when the number of users of an instant messaging application reaches a critical mass, it would generate relative benefit, providing subsequent users with more correspondents, a wider scope of use, and attracting third-party businesses (e.g., a software developer) to join, which in turn attract more users by making the application use easier and more convenient [18].

Although most early researches applied network externalities to explain the increase an individual’s perceived economic value of a product or service [3], later studies found that aside from economic value, individual’s positive affective and cognitive beliefs toward a product or service come into being for the sake of the increase of users [18][29]. User’s satisfaction and evaluation, for example, are two kinds of affective or cognitive belief towards product or service.

Katz and Shapiro (1985) in their work also identified two types of network externalities: direct and indirect. Direct network externalities directly derive value and benefit from the number of users consuming the same product or service. For example, when the users of a mobile SNS platform increase, individual user has the access to interact with more peers. In contrast, indirect network externalities arise when there are more complementary or compatible products and services available, rather than directly derive value from the number of users in a given network [16]. For instance, the wide adoption of Windows operation systems leads to rich software and applications running on them. But Linux has fewer available applications due to its limited number of users. Based on the viewpoints of prior researches, Lin and Lu (2011) concluded that direct network externalities are due to the demand side of the network, while indirect network externalities are the supply side. In this study, we focus only on the demand side of the network, concentrating on how users behave and affect each other, so we consider only the direct externalities here.

RESEARCH MODEL AND HYPOTHESES

Figure 3 presents this study’s research model, developed based on D&M IS Success Model and network externality theory [23]. Specifically, the model considers that network externalities would affect the information quality, system quality, service quality, and user satisfaction. Then, both information quality and system quality might affect the service quality. Finally, as the IS Success Model indicates, the user satisfaction could affect use.

Figure 3. Research Model

IS Success Model

Based on the updated D&M IS Success model, earlier studies have increased our understanding of the parallel effects of these three dimensions of quality, viewing them as completely separated variables, but they have left unexplored the important
relationships among them. Although the service quality is significant nowadays, surprisingly few studies have examined the joint effects of system quality, and service quality e.g.[31][32]. Kafaji (2013) has tested that the service quality could mediate the relationship between system quality and user satisfaction in e-Government systems. The researchers [34] have also developed the 3Q model in an e-service context to theorize the relationships among the three types of quality, and finally made a conclusion that perceived system quality could influence perceived information quality and perceived information quality might influence perceived service quality in the e-service context.

We suppose that information quality and system quality are conceptualized as the overall evaluation of information and system, respectively, while service quality are more appropriately conceptualized as a consumer’s overall evaluation of the service provision that contains considerations of both content and delivery [1][13][19][27][28]. Thus, when a user perceives a higher information quality (i.e., what content is offered) and a higher system quality (i.e., how it is delivered) in an information system, the user will perceive that its service quality is also be higher. It means if one system with higher information quality or system quality than the other, individuals would also bring it with better evaluation of its service, in other words better service quality than the other.

So, we hypothesize that:

**H1: System quality positively influences service quality.**
**H2: Information quality positively influences service quality.**

**Network Externalities**

Among all the current studies, researchers now tend to use the number of users to represent direct network externalities. Katz and Shapiro has defined network externalities as “the value or effect that individuals obtain from a product or service would bring about more values to other consumers with the increasing number of users, complementary product, or services.”[5]. It indicates that with more users of the system, people would get more values and effects. And between the direct and in direct network externalities mention in the section of theoretical background, we only focus on the direct externalities, thus we use the number of users to represent the direct network externalities, like most current studies do.

Also, taking the social influence into consideration, many researches have confirmed that it might affect individual’s overall judgment [4]. For example, some researchers indicated that network externalities would increase an individual's perceived value of a product or service[15], including both the economic value [3], and his/her positive cognitive and affective beliefs toward the product or service [29][17]. Thus, if individuals found that a number of people around him or her use the same application, they might feel satisfied without considering the real quality of the product or service, since they might suppose they conformed to the mainstream of the society. For example, according to the prior research of SNS, some researchers believed that a user would use an SNS once its participants reach a significant number without further consideration about how the SNS platform really perform. So, we hypothesize that:

**H3: Network externalities have positive effect on user satisfaction.**

As far as we are concerned, network externalities not only exert effect directly on user satisfaction, but also have another mechanism: internalization. In sciences such as sociology or psychology, internalization involves the integration of attitudes, values, standards as well as the opinions from others into one's own identity or sense of self [6]. Individuals engage in internalization process are far more than just following others to adopt an information system and to be satisfied with, instead, they evaluate the performance of the information system. In our context, users notice that many people or most people around them are using the application, so they infer that it may have better information quality, system quality or service quality than other application with similar functions.

Herd behavior [2] or information cascade theory[10] may also provide an explanation of such mechanism: when a person on the street decides which of two restaurants to dine in, both look appealing, and he has no idea which one could serve with better food or better quality regarding other aspects, but he sees that restaurant A has several customers while B is empty, as a result, he chooses A on the assumption that having customers makes it the better choice. In this example, the person infers that the number of consumer can be seen as a signal to indicate a higher food quality or service quality or a competitive advantage against another on other things he care about. Therefore, in our context, network externalities may be viewed by individuals as a clue or evidence to evaluate the information, system and service quality of an application. When individuals find that application A has more users than application B, they may engage in an internalization process and infer that application A should be with better information, system and service quality, and finally feel satisfied. Thus, we hypothesize that:

**H4: network externalities would show influence on information quality**
**H5: network externalities would show influence on system quality**
**H6: network externalities would show influence on service quality**
METHODOLOGY AND RESULTS
This study analyzes the theory in the relative evaluation by applying comparison by difference (e.g., user’s satisfaction toward mobile application – user’s satisfaction toward WeChat official account). So, the participants would answer the same question twice, one for their attitudes towards the WeChat official account, the other for the mobile application, then we process data by subtracting the two scores for the same item. By using this method, we suppose the results would be more reliable and trustworthy, because when answering the questionnaires regarding the features and satisfaction of one information system, these subjects may compare their evaluations with the alternative.

Data Analysis
The research model described in Figure 3 is analyzed using partial least squares (PLS). Partial least squares analysis is a second-generation multivariate technique, which can assess a measurement model (i.e., reliability coefficients, factor analysis) and a structural model (i.e., path coefficients) simultaneously in one operation. Additionally, PLS is suitable for a small sample size, and is not sensitive to non-normal distribution[18].

Measurement Model
In PLS, composite reliability (CR) is the measurement for internal consistency. Despite the system quality, information quality, service quality are the formative variables which do not need to consider its validity and reliability, other reactive variables including user satisfaction, use and network in the model all show high composite reliabilities ranging from 0.83 to 0.93 (Table 1). These numbers are higher than the acceptable 0.70 threshold for field research. For details, please see the row “Reliability” in Table 1 for all the constructs.

There are two criteria for validating discriminant validity in PLS. First, all loadings should be higher than cross-loadings (c.f. the requirement of the factor analysis is stricter, cross-loadings should not be larger than 0.5). Second, the square root of average variance extracted should be larger than the other construct correlations[5] Tables 1 and 2 also present discriminant validity of the constructs. Table 1 shows all loadings for reactive variables are higher than 0.70, except for the first item in USE which is lower than 0.70. However, all loadings on their own constructs are still higher than on other constructs, i.e., comparing the loadings in columns shows that each indicator in the block is higher than other indicators from other blocks.

Additionally, Table 2 shows the average variance extracted (AVE), in which all constructs share more variance with their indicators than with other constructs. Above all, the results confirm that the constructs have adequate convergent and discriminant validity.

Table 1. Loadings and cross-loadings for each construct

<table>
<thead>
<tr>
<th>Reliability</th>
<th>IQ</th>
<th>NE</th>
<th>SQ</th>
<th>SVQ</th>
<th>US</th>
<th>USE</th>
</tr>
</thead>
<tbody>
<tr>
<td>IQ1</td>
<td>0.598</td>
<td>0.107</td>
<td>0.230</td>
<td>0.465</td>
<td>0.359</td>
<td>0.156</td>
</tr>
<tr>
<td>IQ2</td>
<td>0.441</td>
<td>0.260</td>
<td>0.037</td>
<td>0.100</td>
<td>0.368</td>
<td>0.251</td>
</tr>
<tr>
<td>IQ3</td>
<td>0.676</td>
<td>0.432</td>
<td>0.343</td>
<td>0.372</td>
<td>0.321</td>
<td>0.315</td>
</tr>
<tr>
<td>IQ4</td>
<td>0.655</td>
<td>0.329</td>
<td>0.229</td>
<td>0.290</td>
<td>0.449</td>
<td>0.305</td>
</tr>
<tr>
<td>TQ5</td>
<td>0.765</td>
<td>0.276</td>
<td>0.225</td>
<td>0.538</td>
<td>0.410</td>
<td>0.236</td>
</tr>
<tr>
<td>NE1</td>
<td>0.333</td>
<td><strong>0.832</strong></td>
<td>0.434</td>
<td>0.323</td>
<td>0.413</td>
<td>0.423</td>
</tr>
<tr>
<td>NE2</td>
<td>0.424</td>
<td><strong>0.876</strong></td>
<td>0.364</td>
<td>0.160</td>
<td>0.456</td>
<td>0.501</td>
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<td><strong>0.800</strong></td>
<td>0.412</td>
<td>0.212</td>
<td>0.411</td>
<td>0.431</td>
</tr>
<tr>
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<td><strong>0.857</strong></td>
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<td>0.230</td>
<td>0.445</td>
<td>0.565</td>
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<td>0.284</td>
<td>0.501</td>
<td>0.577</td>
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<td><strong>0.756</strong></td>
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<td>0.336</td>
<td>0.430</td>
<td>0.482</td>
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<td>0.837</td>
<td>0.326</td>
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<td>0.291</td>
</tr>
<tr>
<td>SQ2</td>
<td>0.142</td>
<td>0.336</td>
<td>0.518</td>
<td>0.133</td>
<td>0.215</td>
<td>0.085</td>
</tr>
<tr>
<td>SQ3</td>
<td>0.262</td>
<td>0.303</td>
<td>0.766</td>
<td>0.409</td>
<td>0.328</td>
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<tr>
<td>SVQ1</td>
<td>0.346</td>
<td>0.238</td>
<td>0.434</td>
<td>0.751</td>
<td>0.430</td>
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<tr>
<td>SVQ2</td>
<td>0.245</td>
<td>0.150</td>
<td>0.180</td>
<td>0.409</td>
<td>0.210</td>
<td>0.176</td>
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Table 2. Average variance extracted

<table>
<thead>
<tr>
<th></th>
<th>IQ</th>
<th>NE</th>
<th>SQ</th>
<th>SVQ</th>
<th>US</th>
<th>USE</th>
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<td>IQ</td>
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<td>0.451</td>
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<td>SQ</td>
<td>0.355</td>
<td>0.492</td>
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<tr>
<td>SVQ</td>
<td>0.583</td>
<td>0.312</td>
<td>0.427</td>
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</tr>
<tr>
<td>US</td>
<td>0.586</td>
<td>0.534</td>
<td>0.424</td>
<td>0.533</td>
<td>0.614</td>
<td></td>
</tr>
<tr>
<td>USE</td>
<td>0.393</td>
<td>0.599</td>
<td>0.311</td>
<td>0.313</td>
<td>0.560</td>
<td>0.665</td>
</tr>
</tbody>
</table>

Note: The bold typeface number on the leading diagonal are the square root of the variance shared between the constructs and their measures, while ‘NA’ indicates the formative constructs that do not need to consider its AVE. Off diagonal elements are the correlations among constructs. For discriminant validity, diagonal elements should be larger than off-diagonal elements.

Structure Model
Figure 4 shows the result of comparison by the difference for the WeChat official account and the mobile application.

Note: *p<0.05, **p<0.01, ***p<0.001
Network externalities have significant effects on information quality (IQ), system quality (SQ) and user satisfaction (US), with (H4; path coefficient=0.45, t=4.17), (H5; path coefficient=0.49, t=6.11), (H3; path coefficient=0.29, t=2.45) respectively. However, Network externalities do not have significant effect on service quality as the results indicated, therefore, H6 is not supported.

Besides, both information quality and service quality show great significance on user satisfaction, with (path coefficient=0.29, t=2.09), (path coefficient=0.24, t=2.17) respectively, which partly confirms the IS Success Model. However, the system quality does not show significance on user satisfaction (path coefficient=0.08, t=0.18) as the success model said. But the results show that both information quality and system quality have significant influence on service quality, (H1; path coefficient=0.27, t=2.36), (H2; path coefficient=0.51, t=3.23). The user satisfaction also shows importance on use, (path coefficient=0.56, t=7.16) as the result has showed.

**DISCUSSION**

The purpose of the present study is to examine the users’ satisfaction and use action of two similar information systems, whose function are basically the same but their other features are distinguishable. We chose the information systems with similar function in order to avoid the impact brought by the function on user’s satisfaction and their use action. Additionally, there’s a distinct contrast between the WeChat official account and mobile application concerning information and service provided, as well as the system operation mode, which are suitable for our research. As with the measurement, specially, we analyzed our model in the relative evaluation by applying comparison by difference (e.g., user’s satisfaction toward mobile application – user’s satisfaction toward WeChat official account).

With a total number of 6 hypotheses, despite one (H6), the rest of them are supported. We now elaborate below on key findings and limitations.

First, this study reveals that network externalities have a positive effect on information quality, and system quality of an information system. This finding confirms what researchers [15][18] concluded that network externalities affect user’s perceived benefits, in other words, their perceived quality of an information system. If more users come in, sponsors are stimulated to enhance their product, leading to an improvement in information quality, system quality and then user satisfaction. To some extent, this impact can be viewed as a way that network externalities affect user satisfaction mediated by the two types of information system quality, i.e. the information quality and system quality.

However, as with the unsupported hypothesis (H6), the network externalities do not show significant positive influence on service quality. A possible explanation of this result may be that the network externalities do influence service quality positively, not a direct impact, but impact mediated by influencing the information quality and system quality. Actually, this explanation accord with previous conclusions mentioned in section 3 that information quality and system quality are conceptualized as the overall evaluation of information and system, respectively, while service quality are more appropriately conceptualized as a consumer’s overall evaluation of the service provision, which contains considerations of both content and delivery. Because of the compounded feature of service quality, a direct improvement is difficult to achieve. IS owners and sponsors can almost only enhance their product by improving the information quality (e.g., using more advanced technology to attain more accurate information) and system quality (e.g., improving the system performance in response time and stability), so as to achieve an improvement on service quality.

Second, network externalities are also found to have a direct influence on user satisfaction. Unlike what was referred above, another way that network externalities put an effect on user satisfaction is a direct one. Users do not necessarily feel satisfied about an information system because of the improvement of information quality, system quality and service quality. It will also happen just for that there are plenty of people, especially people around them using the information system. We suppose that this results from the normative social influence, which indicates that once there were a number of people use the same application, the individual might find they conformed to the mainstream of the society, so they would feel satisfied.

Third, in terms of IS success, our study found that the impact of both system quality and information quality on user satisfaction are mediated by service quality. As was mentioned in section 3, information quality and system quality are conceptualized as the overall evaluation of system and information, respectively, while service quality should be more appropriately conceptualized as a user’s overall evaluation of the service provided, including both content and delivery. There is, however, a noticeable difference between the mechanism of how system quality affects user satisfaction and that of how information quality works. Our results showed that system quality are almost completely mediated by service quality when posing an influence on user satisfaction, and its direct impact is marginal. When it comes to information quality, however, two paths are both found significantly. This can be explained that information quality is more tangible than system quality. Users can discriminate whether the information provided is accurate, adequate, timely, and reliable, but pointing out the discrimination of a system quality, for example, a clear guidance, a friendly interaction or intelligible steps to use is more difficult, especially when these features have been improved dramatically with the help of today’s technology.
There are several limitations should be acknowledged here.

First, this study focuses on the network externalities perspective to understand the information quality, system quality and service quality, so several other independent variables such as extrinsic motivation, management support, developer’s skills are not well addressed[21]. However, under current circumstances where people connect and communicate more frequently, we suppose the network externalities should be given priorities to investigate further. And this provides an opportunity for future studies to examine other independent variables for the IS Success Model.

Second, this study investigates one single function of the informational application (e.g., weather forecast) in one single culture (e.g., China). Applying the conclusions to other research contexts may be cautioned. Further, in different societies with various cultures, the power of network externalities may be different. Like in European countries where people behave more independently, individuals are less likely to change their attitudes or behaviors to conform to the mainstream of the society. So the network externalities might not have a direct influence on user satisfaction. But this provides an opportunity for future studies to examine the cross-culture issues of IS Success Model.

CONCLUSION

The present study extends research on D&M IS Success Model, which not only adds network externalities to the existing model but also shows the internal relationship among three constructs of the IS Success Model (information quality, system quality and service quality).

The research has made some theoretical contribution.

First, the study highlights the caution needed in considering network externalities under current environment where the connections and communications among individuals become more frequent and close. The result shows that network externalities have great significance on three dimensions of quality, and its effect on service quality actually exerts by the mediating effects of information quality and system quality.

Second, the study also highlights the relationship among information quality, system quality and service quality should not be ignored, where both system and information quality would affect service quality, considering system and information quality might be reflected through service quality.

Third, the method for processing data in this research has hardly been used, but it indeed could help gather more reliable and specific data from participants. We conduct a special measurement of questionnaire by requiring subjects to answer each question for WeChat official account and mobile application respectively. Thus, when answering the questionnaires regarding the features and satisfaction of one information system, these subjects may compare their evaluations with the alternative. Then we analyze the theory in the relative evaluation by applying comparison by difference (e.g., user’s satisfaction toward mobile application – user’s satisfaction toward WeChat official account).

The findings are also of practical importance. Since there are so many applications with same functions in the competitive market, so we suppose this study brings value to the owners or sponsors of the system. According to the results in the study, hey have to fully realize the importance of the network externality, since it can affect the information, system and service quality to some extent. Thus, in order to gain the success of one system, sponsors should strive to increase the number of the users, attracting them to use the system continuously.

APPENDIX

<table>
<thead>
<tr>
<th>Constructs</th>
<th>Questions</th>
<th>Reference</th>
</tr>
</thead>
</table>
| System quality | 1 System is easy to use  
2 The procedure is clear when I use the system  
3 The user interaction in this system is understandable | (Venkatesh and Davis, 2000) |
| Information quality | 1 The system could provide me with accurate information  
2 The system could provide me with abundant information  
3 The information provided by the system could satisfy me need. | (Rai et al., 2002) |
| Service quality | 1 The system provide me with sufficient training when I first use it  
2 The system provide in-time service  
3 I suppose the system is reliable  
4 The system could provide right service  
5 The system is friendly. | (Gefen and Keil, 1998, Shin, 2003) |
| USE | 1 I use this system with a high frequency.  
2 I use many functions in this system  
3 I definitely rely on this system | (Gefen et al., 2003) |
User Satisfaction
1 I am satisfied with the information provided by system
2 I am satisfied with the functions of the system
3 In general, I am satisfied with the system.

Network Externalities
1 I suppose that many people are using this system
2 I suppose that most people are using this system
3 I suppose many people will use this system in the future
4 I suppose many friends around me are using this system
5 I suppose most friends around me are using this system
6 I suppose many friends around me will use this system

REFERENCES


UNDERSTANDING INTENTION TO REPURCHASE ON AUCTION WEBSITES FROM USERS’ IT RELIANCE

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ABSTRACT

Does the level of users’ information technology (IT) reliance lead to differences in the motivation of their intention to repurchase on auction websites? This study identifies two seller service propositions that positively affect buyers’ repurchase intentions either directly or indirectly and aims to make two important contributions. First, this study introduces the concept of service provision, which suggests that buyers’ expectations of service and their perception of service provision around purchase has an impact on customers’ intention to repurchase from the same online seller in auction website. Second, this study examines the impact of service provision on buyers’ repurchase intention both directly and indirectly.

Keywords: auction website, repurchase intention, IT reliance, online service provision

INTRODUCTION

While many studies have investigated repurchase intention in the business to customer (B2C) context, there is a lack of knowledge related to buyers’ repurchase intention from the same online seller in customer to customer (C2C) contexts such as internet auctions involving personal selling. This study aims to address this gap in the literature by trying to understand buyers’ repurchase intention in personal auction websites. Sellers’ reputation, website design and consumers’ personal preference are commonly adopted factors to explain buyers’ repeated purchase intention. While those factors are inherited from the service provision around purchase, this study investigates buyers’ intention to repurchase from the same online seller on auction websites from services that online sellers provide.

Service proposition has been described as the relationships between sellers and buyers and can be regarded as an overview of the online shopping environment [32]. As an overview, it provides a guideline for buyers on an auction website, for instance, in the form of product presentation or seller evaluation. Past research has suggested that the expectation of online service provision is based on personal factors [20 ; 31 ; 33]. In order to assess whether buyers’ personal preferences have an impact on sellers’ service provisions around purchase, perceived service was proposed by Zeithaml et al. [32] as a construct to measure seller performance evaluation as determined by buyers’ personal judgement. Business value and customer preference value are also considered, in addition to service provision in the context of trading environments. The level of knowledge in online shopping environment seems critical when studying buyers’ intention to repurchase, particularly when considering buyers who adopt online shopping with different purposes. The level of information technology (IT) reliance is adopted to identify potential differences in buyers’ motivation to repurchase. Therefore, the focus of this study is to empirically examine factors that influence buyers’ repurchase intentions on personal online auction websites.

The next section of this article addresses the literature review and research hypotheses, followed by a description of the two empirical studies. The last section discusses the findings and implications of this study.

LITERATURE REVIEW

Auction Website and Intention to Repurchase

Auction websites are online trading mechanisms that facilitate trading among members and allow them to trade a product at a negotiated value [29]. Unlike B2C auction contexts where the site operators have control of the product offering and payment receiving, C2C auction site operators allow individuals and small businesses to manage their product listing and payment. For instance, there are C2C auction websites that allow sellers to customise their web page (Yahoo Auction, Taiwan), there are those that offer a secure trading functionality (Taobao), and there are those with the simplest static design which enables online trading (eBay, TradeMe). In the light of this diversity in C2C auction websites and the increased competition among sellers in different online trading environments, knowledge is needed about the sustainability of business models for auction websites. While many online sellers are ordinary people, the desire to attract and retain buyers leads to the adoption of alternative business models [29]. One example is the “feedback” mechanism, where previous trading partners (buyers) review and rate their trading experience [34]. A feedback mechanism is available on most auction websites to help buyers evaluate the trustworthiness of the seller. Insights into sales performance, however, are inconclusive. While Choudhury and Karahanna [5] suggested that the customer loyalty for auction websites based on vendor (online seller) depends on the collective review of the seller, little is known about mechanisms that drive such loyalty development process. Unlike sellers in B2C online trading platforms, the sellers on auction websites may not be registered as a company. These sellers intend to start a business, but lack an established brand and have a lower level of customer loyalty development. The few studies available on this topic have either focused on pricing strategies and customer attraction [13], the confirmation of product quality [3], or the trust relationship between sellers and buyers [7]. While an online seller with a strong business tie can reasonably control most of those factors, online sellers on auction websites depend on the seller’s performance proposition, and have to rely on previous trading partners’ evaluations. As expected service and perceived service reflect those factors, this suggests that both concepts will drive consumers’ intention to repurchase from the same online sellers on an auction website.
Value Proposition for Auction Websites

Expectation of service provision. Consumers’ expectations of service provision around purchasing products from auction websites is a combination of their shopping experiences in offline environments and the promises that the online seller has made [32]. The level of expectation of service provision on an auction website differs with personal experience, and may include people who have rich online shopping experiences through to those who avoid online shopping [24]. Drawing on SERVQUAL, Zeithaml et al. [32] identified five dimensions that influence an individual’s perception of expected service provision. The five dimensions are tangibility, reliability, responsiveness, assurance and empathy which reflected consumers’ referral, personal needs and past experiences. In addition, Schiffman, O’Cass, Paladinino, D’Alessandro, and Bednall [23] reported that the level of expectation of service provision will be influenced by interaction with the sellers during the purchasing process. In addition, the examination of current purchasing experience will have direct impacts on the next purchase service expectation [24; 33].

Based on the level of expected service, researchers have identified factors that will affect the level of expected service, such as website usability, information quality, interaction with sellers and evaluation of sellers. These expectations can be divided into expectations of the products and expectations of the sellers. The expectation of the products is derived from the information that the seller provides to help customers understand the product in the form of pictures and text. The expectation of the seller is mainly derived from reviews from previous trading partners [34]. Bhattacharjee [3] suggested that the degree of expectation of the seller will impact the level of expectation of the products, especially for the first-time buyer. The level of expectation of the products will then influence the self-evaluation of a seller for a repeated buyer.

The concept of expected service is built on the literature describing how buyers perceive sellers they don’t know well, as it mainly aims to understand how buyers judge sellers in evaluations, such as feedback and rating, which are derived from the sellers’ past trading performance, with a primary focus on buyers’ personal preferences. Feedback and rating, which has been described as the evaluation of a particular trading evaluation, thus primarily focuses on the product, and provides little information about expectations of service provision, and is thus conceptually different from expectation of service provision [29]. This is corroborated by empirical evidence. Previous studies have detected a positive correlation between the concepts, but also found evidence for their distinctiveness after examining items that SERVQUAL used to evaluate buyers’ expectations of service provision [32; 33]. Recent studies support the conceptualisation of sellers’ feedback as an outcome of expectation on service provision [10]. It has been empirically confirmed that there is a causal link between expected service and seller’s reputation [10; 23]. Furthermore, a full mediational assessment of expected service between the concept’s antecedents by Zhang [34] found that the extent to which buyers perceived the online seller as a business influenced their reputation with it. The concept of expected service can thus help ascertain the motives for reputation [34].

Other group concepts used in extant research, such as website design, only constitute one dimension of expected service and are, therefore, conceptually different [17]. It has even been suggested that website design might be a less important aspect of expected service [28], a notion that was supported by Hellier, Geursen, Carr, and Rickard [12], who noted that, for the particular case of well-known online stores (i.e., online stores that are launched by designer brands), it was a reputation for distinctiveness among sellers, and therefore the opposite of brand awareness and website design, that drove expectations of service provision. Other studies of online sellers referred to a strong trust relationship between buyers and online sellers, ‘we-ness’ or consciousness of kind, a characteristic that is regarded as the most important of the three traditional characteristics or markers of online shopping environments [24].

In view of the variety of different online seller concepts used in previous studies, the add-on value of expectation of service provision can be found in its use as a theoretical product involvement concept that helps to understand “customers’ intentions when purchasing a particular product and the level of commitment of customers to purchase from a particular brand” over the last decade [25; 27]. Online auction websites differ widely in terms of purpose or size and may range from tight-knit business entities to loose aggregates of individual sellers. Expectation of service has not been applied to research on online auction websites. Häubl and Trifts [9] studied expected service from websites, with individuals judging online shopping environments based on the representation of their offline shopping experiences. Their findings suggested that the expectation of service depends strongly on the level of similarity between realities and virtualisation. The authors concluded that, in less-organised online selling, strong perceptions of expectation of service may be based mainly on the quality of enquiry responsiveness, whereas for well-organised online stores, expected service depended on the quality of information provided. The findings underline the importance of considering the concept of expected service in research on auction websites, as it extends the idea of sellers’ the trustworthiness, which has received considerable attention from researchers who focused on the relationship between buyers and sellers in the online context. The distinctiveness of highly regarded sellers could serve as an important service proposition for auction websites, and may thus be the key to a successful online business model.

Perception of service provision. Perceived service has been identified as an important service proposition for online shopping environments [23; 33]. The concept has been the subject of much debate and a variety of definitions have been developed. A common dominator is that perceived service essentially reflects the evaluation of product and services. This is central to the widely-used definition that was introduced by Bhattacharjee [3]. Research has confirmed that buyers use their personal preferences, and hence the perceived service endowed upon these online stores, to find products, exchange goods, or to establish reputation loyalty development [12; 20; 24]. Perceived service is often defined in term of attributes, such as product
and service quality examination [3], expectation and promise [21], reputation and switching cost [14], and interaction between buyers and sellers [2], which various studies have combined in different ways [10 ; 29]. While these dimensions differ conceptually, they are connected, as buyers from a given online shopping environment are willing to make repeated purchases from the same online seller, because they believe (i.e., empathy) that a similar level of online shopping experience (i.e., simulation and responsiveness) will be maintained by the online seller (i.e., reliability). In other words, product examination, which is safeguarded (i.e., assurance) by examining the products and service quality of online sellers, facilitates strong relationships between buyers and online sellers. In an online context, several studies have focused on perceived service as a driver of online shopping motivation. For instance, Loiacono et al. [17], who investigated how online users perceived website design, concluded that online perceived service can spur the usage of the website. Oliver [19] found that product presentation and interaction with online sellers all enhance the willingness to shop online, while trust only has a positive impact online repurchase intention to an online seller with a greater brand awareness. Gronholdt, Martensen, and Kristensen [8] took a different outcome focus. They studied the impact of perceived service on the level of customer satisfaction, and how the level of satisfaction in turn influenced their preference for the online seller.

**DEVELOPMENT OF HYPOTHESES**

**Direct Relationships**

*Expected service and intention to repurchase.* Customers perceive online sellers with a higher level of expectation of service provision as reliable, trustable and predictable. These characteristics are generally highly valued by buyers [21]. Past research suggests an online seller with a higher expected service provision level serves buyers better than sellers with a lower level of expected service provision [34]. As buyers strive to find predictable and reliable online sellers on an auction website, they are likely to be motivated and willing to spend more time to understand an online seller [29], or as Dholakia [6] suggested, a higher level of product involvement will motivate consumers’ repurchase intention. Drawing on this research, this study expected to find that buyers are searching for a trustable online seller when shopping in the internet context.

*Hypothesis 1a:* Higher levels of expected service are positively associated with increased customers’ intention to repurchase.

*Perceived service and intention to repurchase.* Researchers have argued that confirmation of product quality is an important antecedent to the trust relationship established with an online seller [21]. Parthasarathy and Bhattacherjee [20] observed that a good product quality is the main driving force for online trading. The other perceived service dimensions, reliability and responsiveness, are regarded as post-sale services. The purpose of the post-sale service is to compensate for any disappointment after examining the product [15], which encourages buyers’ willingness to undertake repeated purchases. It also lowers buyers’ perceived level of uncertainty in online shopping. There are several dimensions to the notion of perceived service: the assurance dimension, which has been described as “supervision from a third party” [7], includes assurance about trading and suspension policies from the auction websites. The dimensions of simulation and empathy are more likely to drive repurchase intention as buyers receive the necessary information to support their repurchase decision-making. The reliability and responsiveness dimensions effectively minimise online shopping uncertainty, with extra insurance from the assurance dimension. The five dimensions ensure an on-going intention to visit an auction website, which according to Gronholdt et al. [8], may create “strong customer preference” and hence positively affect buyers’ intention to repurchase. Therefore, this study hypothesises:

*Hypothesis 1b:* Higher levels of perceived service are positively associated with increased customers’ intention to repurchase.

**Indirect Relationships**

*Expected service and business value.* Perceived business value or benefit has been defined as the perceived utility acquired through the product and service that the seller provides through a specific online shopping environment (e.g., based on the performance of competitors in a given online shopping environment). Perceived business value is reflected by shopping support, the add-on value of the product, and brand, which is obtained through product involvement and interaction between buyers and sellers [33]. Sellers perceived as high in the level of expected service due to high degrees of product quality, interaction, and shopping support service should deliver higher value for their buyers compared to online sellers with less expected service [4 ; 34]. As studies on expected service have associated high levels of expectation of service provision with positive product and service quality and brand, this study hypothesises a positive influence of expected service on perceived business value.

*Hypothesis 2a:* Higher levels of expected service are positively associated with increased business value.

*Perceived service and business value.* Among the benefits to be derived from perceived service that have been discussed most frequently in the literatures are (1) confirmation of information provided by sellers, friends and third parties, which may improve buyers’ understanding of the product, an online seller and an online shopping context; and (2) confidence, which is strengthened by strong trust assurance and a positive interaction with an online seller [21 ; 34]. While such benefits are most frequently mentioned in the context of perception of service provision in offline situations (e.g., customer guarantee, customer service), informational and perceived business benefits have also been identified as an outcome of perceived service by Gronholdt et al. [8] in the context of online shopping. Therefore, this study hypothesises:
Hypothesis 2b: Higher levels of perceived service are positively associated with increased business value.

Expected service and consumer preference value. This study posits that the benefits and value to be derived from high levels of expected service will not only be restricted to the business sphere, but encompass consumer preference value (i.e., direct and indirect customer action intention) for buyers, as well. Previous studies suggest that buyers with a high expectation on service provision are more rely on online sellers who provide a positive trading experience than buyers with a low expectation on service provision [22]. Schiffman et al. [23] argue that the service provision exceeds buyers’ expectation sends a message to the buyers that the seller will act in buyers’ best interests and is willing to fulfil buyers’ personal preferences. Moreover, a study by Dholakia [6] demonstrated that product involvement, which is representative of a high level of expected service, can have a favourable impact on consumer preference. The author attributed this positive effect partly to high levels of personal needs, product value, and loyalty to a brand (seller).

Hypothesis 3a: Higher levels of expected service are positively associated with increased consumer preference value.

Perceived service and consumer preference value. In the literature on buyers’ personal preferences, it has been argued that trading experiences in online shopping environments can affect trust and reliability positively and negatively, which facilitates the exchange of personal preference that otherwise might be difficult to get hold of through monetary trading [30]. This study argues that confirmation of product and service quality, interaction and compensation and supervision from a third party will increase buyers’ likelihood of realised consumer preference benefits. Hence, this study hypotheses that perceived service will have a positive impact on buyers’ realised personal preference values.

Hypothesis 3b: Higher levels of perceived service are positively associated with increased consumer preference value.

Impact of the Level of Information Technology (IT) Reliance
This study argues that the level of information technology (IT) reliance in daily tasks (i.e., using the internet to participate in this research vs. a preference for a paper-based survey) is likely to affect the result of business and customer preference value on intention to repurchase from an auction website. Gefen et al. [7] showed that users with a lower level of IT reliance aimed to avoid or minimise uncertainty and tended to have a stronger customer preference value. For frequent IT users, on the other hand, business value is more likely to be realised. Other studies support this, stating that consumers are more likely to act loyally to a particular seller in a less familiar environment [19 ; 24]. Drawing on the characteristics of both types of IT reliance, Gefen et al. [7] suggested that online trading which consisted of money exchanges were associated with consumer preference value, whereas business value was more important for users who preferred add-on value when purchasing from the internet. Therefore, this study argues that the use of an auction website will differ depending on users’ IT reliance. In particular, it is believed that users with a lower level of IT reliance relationships in auction websites will base their judgements on the fulfillment of a particular need, relative to highly IT-reliant users, who have already adopted IT to complete daily tasks. Buyers’ relationships with online sellers are therefore likely to be interdependent, characterised by paying for not only the product, but for additional benefits. This was corroborated by Pavlou et al. [21] who concluded that offering the same level of service to reduce the difference between online and offline shopping did not drive the willingness to repurchase from the same online seller. IT-dependent users’ intention to repurchase, on the other hand, may be based on shopping habits. In consumer decision-making models, business value has less impact on consumers with lower self-confidence in making decisions. IT-independent users’ purchasing from an auction website will be more careful and considered than IT-dependent, and, therefore, characterised by the concepts of commercial activities. As trading partners anticipate future trading, but do not expect to receive monetary payment for their extra service provision around purchasing [13], it is expected that business value will be a strong driver on intention to repurchase for IT-dependent users, relative to IT-independent users. Furthermore, IT-independent users enjoy the consistency and reliability of online shopping experiences with the online sellers they are familiar with.

Hypothesis 4: Business value will have a more positive impact on intention to repurchase for IT-dependent users, compared to IT-independent users.

Hypothesis 5: Consumer preference value will have a more positive impact on intention to repurchase for IT-independent users, compared to IT-dependent users.

DATA ANALYSIS AND FINDINGS
Sample and Procedure
This research study was conducted among online buyers who have online trading experiences on auction websites but different levels of IT reliance. Online buyers who only adopt IT to perform particular tasks tend to have less confidence in internet-enabled activities; whereas online buyers who prefer to use the internet as a means to process daily tasks tend to have a higher level of trust in internet-enabled activities. The survey was sent to students who enrol in one of the universities in New Zealand during 2012 through an online survey invitation and a paper-based invitation over a period of four weeks. People who are invited to the survey can choose the way to participate in this research freely. The respond rate was 29.5% with a total of 1000 survey invitation sent to potential participants. After the omission of missing values, the sample consisted of 143 usable responses from the paper-based survey. There were more female respondents than male respondents (70% female and 30%
male). With regard to age, the distribution of the sample was skewed toward the lower age categories (86% were aged between 18 and 24 and 13% between age 25 and 35). Ninety-three percent of participants used TradeMe (an auction website in New Zealand) with a shopping frequency of between 1 and 3 times monthly and only 7% shop on TradeMe with a higher frequency (i.e., more than three times per month). Sixty-nine percent of participants were online buyers with at least one year of online shopping experience. The online survey received 154 valid responses. There were more female respondents than male respondents (60% female and 40% male). Sixty-two percent of the online survey participants were aged between 18 and 24, 34% of them were between 25 and 35. Ninety-two percent of participants preferred to use TradeMe as their trading platform. Although the majority of participants had a lower online shopping frequency (76% between 1 and 3 times monthly), 24% of them shop online with a higher frequency. Eighty-one percent of participants had at least one year of online shopping experience.

**Measures**

With the expectation of service and perception of service, measures were based on past studies and were adapted to fit the context of this study. The survey used 7-point Likert-type scales for all items, anchored by strongly disagree/agree. Expected service was measured by 18 items to understand what customers expected of online service provision in terms of simulation, empathy, reliability, responsiveness and assurance. Perceived service was measured by 15 items from the same 5 dimensions. The five dimensions are adapted from Zeithaml et al. [32]. Potential business benefits to be derived from auction websites were identified by browsing various auction websites. Based on buyers’ activities on auction websites such as TradeMe, eBay, and others, 6 items were identified to capture the business value perception. With respect to diversity in sellers’ goal, customers’ personal preference and their motivation to repurchase from the same seller become increasingly important. Since customers’ personal preference has been proposed as a key factor for business operation, 7 items were developed to measure consumer preference value. Buyers’ intention to repurchase is measured by 6 items.

**Measurement Model and Analysis approach**

Partial least squares structural equation modelling (PLS-SEM) was employed. PLS aims to identify the correlation between variables to explain and predict outcomes [11]. The analysis was conducted with WarpPLS 3.0 software [16]. The five constructs are reflective measurements which aim to understand the construct from different perspectives. The two-step evaluation procedure is followed: the measurement model first, followed by an estimation of the structural model. In order to assess the psychometric properties of the multiple item scales, the measurement model was estimated by calculating individual indicator reliabilities, composite reliability (R), convergent validity and discriminant validity [11]. The measurement model was estimated with the PLS algorithm and bootstrapping procedure (999 samples). Combined loading and cross-loading was used to describe the convergent validity. Any item with a factor loading lower than 0.6 was removed to ensure each item contributed to the designed construct rather than other constructs [11]. Internal consistency was evaluated by examining the composite reliability (CR) score and Cronbach’s α (CA) for each latent construct. The recommended threshold for CR and CA is 0.7. Discriminant validity is evaluated in two ways. First, each latent construct should have a higher square root of Average Variance Extracted (AVE) than any of the correlations involving the latent variable [11]. Secondly, each indicator is examined to ensure a factor loading is higher on the designed construct than all of its cross-loadings with other latent variables. While the results of the measurement model resemble the outcomes of principal component analysis, the path coefficient is calculated, as part of the structural model can be interpreted in a similar way as the β coefficient in an ordinary least squares regression. A structural model is specified in PLS and analysed by the PLS algorithm with bootstrapping procedures to obtain path coefficients, the associated p-value and R² coefficients of the constructs [11]. Evaluating the quality of the PLS model is similar to multiple regressions where the path coefficients and the relative R² are examined. Hair et al. [11] proposed that the acceptable threshold for the size of R² is 0.10 in general; however, the value of 0.20 is considered high in consumer behaviour study [26].

**Model 1: Online Buyers with Lower Reliance on Internet Technologies**

Items that are removed due to insufficient factor loading on the designed construct from model 1 are presented in the appendix. Internal consistency is not satisfied by an extremely low CA score for business value (Table 1).

<table>
<thead>
<tr>
<th>Table 1. Composite Reliability (CR), Average Variance Extracted (AVE), Cronbach’s α (CA), Correlations for model 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>CR</td>
</tr>
<tr>
<td>-----------------</td>
</tr>
<tr>
<td>Expected Service (ES)</td>
</tr>
<tr>
<td>Perceived Service (PS)</td>
</tr>
<tr>
<td>Business Value (BV)</td>
</tr>
<tr>
<td>Customer preference value (CPV)</td>
</tr>
<tr>
<td>Intention Repurchase (IR)</td>
</tr>
</tbody>
</table>

Note: square roots of average variances extracted (AVE’s) shown on bold.

However, the main problem is that business value only has two indicators. The construct, business value, is retained in this model since the two indicators are highly loaded on business value. The level of convergent validity is indicated by AVE. As shown in Table 1, perceived service has an AVE score lower than 0.5. As a lower AVE is often caused by confused factor loading, factor loadings were examined to ensure they were highly correlated with the designed construct. The indicators
showed high loading on the designed construct and low on other constructs. The internal consistency and convergent validity was acceptable with all indicators being highly contributed to the designed construct. The result for discriminant validity was satisfied. This assessment indicates that table 1 provides a reasonable level of reliability and validity of the reflective latent variable.

Figure 1. Influence of service provisions on intention to repurchase for online buyers with lower level of reliance in IT

The hypothesis-testing results are presented in Figure 1. In line with Hypotheses 1a and 1b, expected service and perceived service positively impacted users’ repurchase intention to the same seller in online auction websites. The impact from perceived service, however, was not significant. The estimation model confirmed Hypotheses 2a and 2b, which suggested that expected service and perceived service will positively impact users’ perception on business value. Business value accounted for by expected service and perceived service was $R^2 = 0.28$. A positive effect of expected service and perceived service for customer preference value (Hypotheses 3a and 3b) was expected, however, the impact from perceived service was non-significant. For customer preference value, expected service and perceived service accounted for a $R^2$ value of 0.15, which was considerably lower than that for business value. Business value had a positive impact on users’ intention to repurchase, but the impact was non-significant. The customer preference value positively influenced users’ intention to repurchase, but it was not significant. The combined variance in intention to repurchase explained by the model, including expected service, perceived service, and business and consumer preference value resulted in a $R^2$ value of 0.32. While the predictive quality of the model slightly weakened when the indirect factors business and customer preference value were excluded ($R^2 = 0.28$), the effect size of this difference was weak. Observing the total effects (Table 2), it can be concluded that expected service contributes a significant part to intention to repurchase. Furthermore, the total effect of business value on intention to repurchase appears to be higher than the total effect of customer preference value.

Table 2. Total Effects on Latent Constructs on IR

<table>
<thead>
<tr>
<th>Model 1</th>
<th>Total effect</th>
<th>P Value</th>
<th>Effect sizes</th>
<th>Model 2</th>
<th>Total effect</th>
<th>P Value</th>
<th>Effect sizes</th>
</tr>
</thead>
<tbody>
<tr>
<td>ExpSer -&gt; IR</td>
<td>0.409</td>
<td>&lt;0.001</td>
<td>0.204</td>
<td>ExpSer -&gt; IR</td>
<td>0.169</td>
<td>0.090</td>
<td>0.080</td>
</tr>
<tr>
<td>PerSer -&gt; IR</td>
<td>0.200</td>
<td>0.059</td>
<td>0.077</td>
<td>PerSer -&gt; IR</td>
<td>0.386</td>
<td>&lt;0.001</td>
<td>0.206</td>
</tr>
<tr>
<td>BV -&gt; IR</td>
<td>0.192</td>
<td>0.078</td>
<td>0.085</td>
<td>BV -&gt; IR</td>
<td>0.565</td>
<td>&lt;0.001</td>
<td>0.399</td>
</tr>
<tr>
<td>CPV -&gt; IR</td>
<td>0.107</td>
<td>0.154</td>
<td>0.029</td>
<td>CPV -&gt; IR</td>
<td>0.165</td>
<td>0.018</td>
<td>0.080</td>
</tr>
</tbody>
</table>

Model 2: Online Buyer with a Higher Level of Reliance on Internet Technologies

All item loadings exceeded the threshold of 0.6 with a significant P value. The internal consistency and convergent validity of the measures proved satisfactory, as all CR scores exceeded the threshold of 0.7, and all AVE scores were higher than 0.5 (Table 3). Discriminant validity was satisfactory as well: first, the AVE score of each latent variable exceeded the construct’s squared correlation with any other latent variable [16]. Second, each indicator’s loading was higher than all of its cross-loadings with other latent variables. The reliability and validity for the reflective measurement model were thus supported.

The hypothesis testing result for model 2 is presented in Figure 2. In contrast to model 1, expected service and perceived service did not have a significant, direct impact on intention to repurchase. Hypotheses 1a and 1b for model 2 (Table 4) were thus rejected. The analysis result confirmed Hypotheses 2a and 2b, which suggested a positive impact of expected service and perceived service on business value. The explained variance in business value accounted for by expected service and perceived service was $R^2 = 0.42$. The positive effect of perceived service on customer reference value was confirmed, but the positive impact from expected service to customer preference value was not supported. Hypothesis 3b was rejected but accepted Hypothesis 3a. The explained variance in customer preference value by expected service and perceived service was $R^2 = 0.16$ (Figure 2). Business value had a strong and positive impact on users’ intention to repurchase. The customer preference value also had a positive and significant influence on users’ intention to repurchase. The combined variance in intention to repurchase explained by the model including expected service, perceived service, business value, and customer preference value, resulted in a $R^2$ value of 0.53. The predictive quality of the model deteriorated when the indirect factors business value...
and consumer preference value were excluded ($R^2=0.31$), and the effect size of this difference appeared to be strong (0.22). When considering the total effects (Table 2), it can be concluded that the total effect of perceived service on intention to repurchase was somewhat higher than the total effect of expected service, which was not significant. Furthermore, the total effect of business value was significant and higher than the total effect of customer preference value, which was also significant.

Table 3. Composite Reliability (CR), Average Variance Extracted (AVE), Cronbach's α (CA), Correlations for model 2

<table>
<thead>
<tr>
<th></th>
<th>CR</th>
<th>AVE</th>
<th>CA</th>
<th>ES</th>
<th>PS</th>
<th>BV</th>
<th>CPV</th>
<th>IR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expected Service (ES)</td>
<td>0.967</td>
<td>0.618</td>
<td>0.963</td>
<td>0.786</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perceived Service (PS)</td>
<td>0.946</td>
<td>0.540</td>
<td>0.939</td>
<td>0.431</td>
<td>0.735</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Business Value (BV)</td>
<td>0.881</td>
<td>0.516</td>
<td>0.842</td>
<td>0.575</td>
<td>0.521</td>
<td>0.746</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consumer preference value (CPV)</td>
<td>0.910</td>
<td>0.560</td>
<td>0.887</td>
<td>0.152</td>
<td>0.375</td>
<td>0.515</td>
<td>0.748</td>
<td></td>
</tr>
<tr>
<td>Intention Repurchase (IR)</td>
<td>0.917</td>
<td>0.649</td>
<td>0.890</td>
<td>0.447</td>
<td>0.487</td>
<td>0.693</td>
<td>0.454</td>
<td>0.806</td>
</tr>
</tbody>
</table>

Note: square roots of average variances extracted (AVE’s) shown on bold.

Figure 2. The impact of service provisions on intention to repurchase for online buyers with higher level of reliance in IT

**The Level of IT Reliance and Perceived Value Propositions**

To test Hypotheses 4 and 5, the analysis results of model 1 and model 2 were compared (Table 4). The impact of business value on intention to repurchase was moderated by participants' IT reliance so that business value was a more important driver for users who had a higher level of IT reliance ($\beta = 0.565$) than people with a lower level of IT reliance ($\beta = 0.192$). Hypothesis 4 was supported by this study. The comparison between the two studies suggests that customer preference value is a more important driver for IT-dependent users ($\beta = 0.165$) than IT-independent users ($\beta = 0.107$). Hypothesis 5 was rejected in this study.

Table 4. Hypotheses Testing - Path analysis ($\beta$, P Value)

<table>
<thead>
<tr>
<th>Path</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Hypotheses</th>
<th>P Value</th>
<th>Hypotheses</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1a:ES -&gt; IR</td>
<td>0.326</td>
<td>&lt;0.001</td>
<td>Supported</td>
<td>0.022</td>
<td>0.414</td>
<td>Rejected</td>
</tr>
<tr>
<td>H1b:PS -&gt; IR</td>
<td>0.122</td>
<td>0.164</td>
<td>Rejected</td>
<td>0.122</td>
<td>0.063</td>
<td>Rejected</td>
</tr>
<tr>
<td>H2a:ES -&gt; BV</td>
<td>0.402</td>
<td>&lt;0.001</td>
<td>Supported</td>
<td>0.356</td>
<td>&lt;0.001</td>
<td>Supported</td>
</tr>
<tr>
<td>H2b:PS -&gt; BV</td>
<td>0.202</td>
<td>0.022</td>
<td>Supported</td>
<td>0.355</td>
<td>&lt;0.001</td>
<td>Supported</td>
</tr>
<tr>
<td>H3a:ES -&gt; CPV</td>
<td>0.057</td>
<td>0.265</td>
<td>Rejected</td>
<td>0.379</td>
<td>0.001</td>
<td>Supported</td>
</tr>
<tr>
<td>H3b:PS -&gt; CPV</td>
<td>0.365</td>
<td>&lt;0.001</td>
<td>Supported</td>
<td>0.565</td>
<td>&lt;0.001</td>
<td>Supported</td>
</tr>
<tr>
<td>H4:BV -&gt; IR</td>
<td>0.192</td>
<td>0.078</td>
<td>Supported</td>
<td>0.165</td>
<td>0.018</td>
<td>Rejected</td>
</tr>
<tr>
<td>H5:CPV -&gt; IR</td>
<td>0.107</td>
<td>0.154</td>
<td>Rejected</td>
<td>0.107</td>
<td>0.154</td>
<td>Rejected</td>
</tr>
</tbody>
</table>

**DISCUSSION AND IMPLICATIONS**

The purpose of this study was to expand the understanding of viable value propositions for the types of users on auction websites and investigate how these can be translated into profits. This study identified that expected service and perceived service influenced users’ intention to repurchase from the same online seller, either directly or indirectly. Moreover, whether perceived businesses and customer preference value can explain this intention depends on users’ IT reliance, as well as on the type of the online sellers in auction websites. This study contributes to the academic literature in several ways. First, it adds insights to the literature on value propositions for auction websites expectation of service provision. By linking expectation of service provision to users’ perceptions of increased business and consumer preference value as well as their intention to repurchase from the same online seller, the results confirm that the concept is an important value proposition for auction websites. Differences exist, however, dependent on users’ IT reliance. Where users had a lower level of IT reliance (model 1),...
expected service had a direct effect on users’ intention to repurchase. In users with higher IT reliance (model 2), the expectation of service provision only seemed to increase intention to repurchase indirectly, through business value. Interestingly, a similar pattern also emerged for perceived service in model 2. Although the hypotheses regarding the direct effects of expected service and perceived service on intention to repurchase were not supported by model 2, the findings do seem plausible. As users with a higher level of IT reliance focus more on the add-on value that online sellers provide and develop, diverse preferences, including evaluation of service quality, may be less pronounced, which explain the lack of a direct effect on intention to repurchase. By extending the existing research on expected service which had been conducted primarily in the offline shopping environment [32] and B2C online shopping environment [3], this study demonstrated the viability of the construct in the C2C online setting.

Second, this study adds insight to the online academic debate about whether and when C2C online business models are successful [34]. While some researchers argue that it is almost impossible for online sellers to create business value from auction websites [18], others claim the nature of C2C online trading platforms is to ignore the importance of business value. So far, the focus has been on the feedback and rating mechanisms [29; 34]. This study extends insights by investigating the joint impact of expected service and perceived service as direct and indirect predictors of action in terms of website profit return. Interestingly, the results of model 2 suggest that, in the case of the higher level of IT reliance, the underlying logic for how business and customer preference values are realised might differ. As recommended by Gefen et al. [7], a higher level of understanding of auction websites may realistically help in realising the benefit that online sellers provide. These authors refer to this phenomenon as “self-learning” [1] and warn of possible backfire effects on perceived service, which may be reflected by the findings from auction websites. However, no such indication of backfire effects on realised customer preference value was detected, in this study.

Finally, the results underscore the importance of considering users’ IT reliance. The results of the study suggest that users with a lower level of IT reliance might be characterised by trading for products, mostly motivated by a higher level of expectation of online shopping, rather than perceived service, business value and customer preference value [3; 21]. However, the findings from online shopping, business value and consumer preference value align with the self-learning process, according to which customers’ preference values are more important for behaviour, rather than environmental factors [19; 22]. Although, for auction websites, business value appeared to be more important for users with a higher level of IT reliance, it seems that the main goal of the platform is to offer users a safe and convenient shopping channel. More generally, it can be concluded that users with a higher level of IT reliance value the benefits that businesses provide (business value) and have a better understanding of their own preferences (consumer preference value). Such trade or self-learning processes, which are triggered by economic and non-economic benefits, seem to be accepted in a context that is driven primarily by effectiveness and convenience. This study provides preliminary evidence that users’ level of IT reliance when using auction websites involves different business benefit perceptions, and therefore different customer preferences.

Managerial Implications
This study offers practical insights for online sellers on auction website who aim to retain customers by service provision around purchasing. In this way, online sellers may positively affect buyers’ intention to repurchase not only from the same auction website platform, but the same online seller. The findings suggest that for online sellers who adopt auction websites with a profit generation purpose it seems advisable to generate business value and consumer preference values for users who have a higher level of IT reliance, and a higher level of expectation of service provision for users with a lower level of IT reliance. Online sellers should consider providing a service with better quality that leads to business value, such as offering quality products, caring customer service and a responsible attitude. For users with a lower level of IT reliance, however, it seems advisable to reverse the focus by maintaining a higher level of expectation of products and positive interaction between sellers and buyers, while developing a trust relationship to encourage future trading. However, as motivations to repurchase from the same online seller are likely to be reflected by the trading process rather than add-on values, these recommendations should be adopted with a clear understanding of the target customers. Online sellers in auction websites who aim to start their business from an online channel, such as Trade Me, should value both business benefits and consumer preferences for both types of online users. It should be noted, however, that the awareness of such benefits seems even more important for users with a higher level of IT reliance than users who are IT-independent.

Limitations and Future Research
The data was collected from online auction users in one university in New Zealand. Future study should apply the proposed model on different group of users in different countries to improve the understanding in the relationship between IT reliance and online auction repurchase behaviours. Future research should consider different auction websites, for example Yahoo Taiwan and Taobao, which are different from the one in this study in order to test the identified approach. Moreover, actual behaviour data could provide valuable insights, in addition to the intention to repurchase. As expected service, perceived service, business and consumer preference value only explained 32% of the variance for intention to repurchase from model 1, this suggests there are other factors to be explored for users with a lower level of IT reliance. Future research could also collect data by observing users’ online shopping behaviours to identify other factors that may influence or motivate intention to repurchase.
REFERENCES


The Fifteenth International Conference on Electronic Business, Hong Kong, December 6-10, 2015
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APPENDIX

The measurement for each construct in both models:

(Those measurements removed from Model 1 are presented in italic).

Expected service. The website should be easy-to-use and user friendly; The product/information should be easy to find; The website needs to be fast loading and well organising; Online sellers should provide detail product pictures to help customers in understanding the product; The information related to the product should be useful and help me making judgment about the product; Online sellers should set up a special channel for any problem that customers have with their received orders; Online sellers should compensate to customers’ satisfaction; Online sellers should have guarantees/refund policy available to protect my benefits; Online sellers should take full responsibility to any problem that may occur with my order; Online sellers should have the customers’ best interest at heart; Online sellers should act as they promised; Online sellers should respond to my question with information which helps me with my decision making; Online sellers should respond to my request within a reasonable period of time; Online sellers will be consistently courteous with customers; With problems in my order, online sellers should respond to me satisfactorily; Online sellers should have a well-established post-sale service; The auction website provider (Trademe) should provide a secure shopping environment; The order progress should be available online.

Perceived service. Their websites are easy-to-use and user friendly; The product and its related information are easy to find; Their websites are fast loading and well organizing; The pictures of product assist me in making decision; I can use those information related to the product to judge its quality; I can reach them easily if there has any problem in my order; They act responsibly when there is problem in my order; Their respond is useful and assist me in decision making; I receive their responds in reasonable period of time; They give special care to every customer’s request; I am satisfied with their responds; I shop with them because of their brand and reputation; This online seller has a well-organised and caring post-sale service; Shopping on auction websites is safe; I can track and trace my order progress.

Consumer preference value. I can name those online sellers whom I often shop with; I save of those online sellers whom I often shop with into favourite; I will recommend my friends those online sellers whom I often shop with; I will browse the product listing of the online sellers I often shop with when I am bored; I will follow them on Twitter and/or Facebook if it is available; I will only turn to their competitor when they do not have the product I need.

Business value. I shop with particular online seller because I know they are reliable; I will check online sellers’ feedback before I make purchase; I will shop with online sellers who offer special services (e.g. fast delivery, credit payment); I shop on auction websites as price comparison is easy and fast; I shop on auction websites for bargain; I shop on auction websites because of convenience, time-saving and no geographic limitation.

Intention to repurchase. I am willing to repurchase from the same online seller if the quality of product from last experience achieve my expectation; Due to special needs/products request (e.g. style, rarity of product), I am willing to repurchase from the same online seller; I am not willing to repurchasing from the same online seller if there are unsolved complaints in their feedback; I am willing to make a repurchase with online sellers who have some bad feedback if they have a good reputation in general; With similar product and service standards, I am more willing to make repurchases if the price is reasonable; I am willing to make repurchase from the same online seller only when they producing the product I like.
UNDERSTANDING THE ROLE OF IOT TECHNOLOGIES IN SUPPLY ECOSYSTEMS

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Andrew Madden, University of Sheffield, UK, a.d.madden@sheffield.ac.uk

ABSTRACT
This paper introduces the concept of supply ecosystems for exploring the role of the Internet of Things (IoT) and its technologies in value added activities. The paper argues that the IoT has a role in helping to understand the information problems that firms face, and in identifying the way in which IoT technologies can help. To achieve this, the paper examines the vision and scope of the IoT and its perceived potential value to firms. Then, based on the available literature, the paper furthers the existing concept of supply ecosystems and argues that the potential value of the IoT to businesses can only be realized if a holistic, more ecological perspective, is used. The paper hence proposes that supply ecosystems can be used to understand the value of IoT in solving information problems.

Keywords: Internet of things, supply chain, ecosystems, information, decision making.

INTRODUCTION
Recent developments in the Internet of Things (IoT) have promised to help solve some profound problems in the production and consumption of goods and services [6]. According to a report from The McKinsey Institute, the IoT has the potential to add $6.2 trillion to the global economy by 2025 [23], and survey results by Accenture [1] predicted that the Industrial IoT could possibly add $14 trillion to the global economy by 2030. IoT technologies have been in use for many years in domains such as manufacturing, transport management, and energy conservation. Only recently though, have they been widely discussed in the media. While businesses and governments around the world are optimistic about the prospect of a more productive future brought by IoT technologies, there are questions that must be addressed in order to explore and exploit the opportunities offered by the IoT. In the context of supply chain management foundational questions would be What does IoT mean to firms? How and in what ways should firms use these technologies in order to exploit the opportunities presented by the technologies?

This paper addresses these questions by exploring the concept of supply ecosystems. It argues that they have a role in helping to understand the information problems that firms face, and in identifying the way in which IoT technologies can help. To achieve this, the paper examines the vision and scope of the IoT and its perceived potential value to firms. Then, based on the available literature, the paper furthers the existing concept of supply ecosystems and argues that the potential value of the IoT to businesses can only be realized if a holistic, more ecological perspective, is used.

This paper is organized as follows. The next section discusses the concept of the IoT and its perceived value. The subsequent section explores the idea of ecosystems and how they can be used to better understand competition and business activities. The discussion leads to a concept of supply ecosystems; this is then applied to examine information problems encountered in the conventional supply chain settings. Based on the previous discussion, the role of IoT and its value in supply ecosystems (in particular its contribution to solving information problems) is then discussed. The final section explores how the ideas proposed in this paper might help to define the future directions of the IoT in supply chain research.

INTERNET OF THINGS
The phrase ‘Internet of Things’ (IoT) was first used in 1999 during a presentation given to Proctor & Gamble by Kevin Ashton, who used it to describe the interactions that arise when everyday objects with embedded sensors or chips are incorporated into a network. Today, the term is widely used to describe a situation where “everyday objects can be equipped with identifying, sensing, networking and processing capabilities that will allow them to communicate with one another and with other devices and services over the Internet to accomplish some objective” [38, p.261]. The IoT describes a world in which objects, using a combination of hardware and software technologies, make themselves recognizable to each other, and can be connected via the Internet to any person and anything at any time and place [35]. Hardware technologies include devices (e.g., sensors, actuators, smartphones, and wearable technologies), and networks to connect them (e.g., 4G Long-Term Evolution, Wi-Fi, and Bluetooth); while software components include cloud computing, analytics programmes, and data visualization tools [7].

The IoT is argued by some to be more than a network of hardware and software. Shin [32, p.520] describes it as “a socio-technical ensemble” and stresses that its design and development should be based on human needs. Indeed, there is evidence to show that automation or electronic integration alone without business transformation is not sufficient to improve business operation through the IoT [16] and that contingency factors have profound influences on value creation from RFID supply chain projects [36]. As noted by Walport [37, p.19] “people will be an integral part of those systems”. Cisco has expanded the idea of the Internet of Things to an Internet of Everything (IoE) by including people and process (Figure 1) and has argued that in order for the promise of the IoT to be realized, all elements in the network (i.e. people, process, data, and things) have to be appropriately developed.
The current perceived value of the IoT can be examined at two levels: operational and strategic. At an operational level, IoT sensor data can be used to regulate flows of materials, products, and information on the shop floor with minimum human intervention. Sensor data can also be used to automate replenishment by sending to the supply chain system a signal that triggers a delivery. At strategic levels, IoT technologies can capture data through different devices and applications that connect within and across different sectors. In this sense the real value of the IoT comes from using such data to inform decision making in ways that make it more responsive and immediate than is currently possible. As was noted in The Economist [4, p.21] “the most exciting possibilities, perhaps, will emerge from the insight provided by the amount of new data being generated, captured and analyzed and the value that is generated from such information”. In addition, the volume and velocity of data can lead to innovations that change business models. Radio-frequency identification (RFID) tags are increasingly being used to help firms achieve a circular business model by tracking the whereabouts and usage of the materials [30]. This helps to reduce costs and increase margins, and most importantly affords opportunities to reintegrate products back into the economic system at the end of their current use [20].

So far there is no universal definition for the IoT and there is no agreement on its true value to those who adopt it, e.g. individuals, organisations, and governments. This paper views the IoT as a socio-technical ensemble including people, process, data, and things that possesses the following characteristics:

- It is a network not only of things but of people interacting through processes with things or with other people.
- The value of IoT technologies can only be realized when they are connected to other devices.
- Connected devices can make themselves recognizable to others so that they can communicate with others and with their environment via the Internet.
- The IoT senses, captures and exchanges enormous volumes of near real-time data that is potentially valuable to firms with the right analytical tools.
- An IoT technology can capture data through different devices and applications that connect within and across different sectors. In other words, it is a boundary object that can spin across organizational boundaries to coordinate actions.
- The more that people, things, and processes connect in the IoT, the more valuable it becomes; and so too does the data it captures and generates.

**BUSINESS ECOSYSTEMS**

James Moore was one of the first people to promote the idea of business ecosystems [25]. He drew on some key concepts from ecology and argued that firms should not be viewed as discrete entities, but as parts of a business ecosystem comprising competitors and collaborators and infrastructure. Moore [26, p.33] describes a business ecosystem as “an intentional community of economic actors whose individual activities share in some large measure the fate of the whole community”. A business ecosystem can be regarded as a network of interdependent organisations whose services and products complement each other.

Building on Moore’s work Iansiti and Levien [11] described a business ecosystem as “a large number of loosely interconnected participants who depend on each other for their mutual effectiveness and survival” (p.8). They emphasized the holism of an ecosystem and argued that its health significantly affects its members’ performance and that the fate of a firm is intertwined with other elements and of its business ecosystem.

The parallels between business ecosystems and biological ecosystems make it possible to draw on concepts from the latter to describe the former [12, 18]. Iansiti and Levien, for example, drew on the ecological concepts of keystone species and co-evolution to describe the dynamics of the system and the complexity of relationships (e.g. competitive yet interdependent and

*Source: [5]*
collaborative) within a business network [11]. Two of these parallels are considered in the following subsections: keystone species and co-evolution, which briefly discuss these key concepts from ecology to describe business dynamics and inter-firm relationships. The section on limiting factors discusses a further idea from ecology that has particular relevance to supply chain management.

Keystone
Keystone species are disproportionately influential species in an ecosystem as they regulate ecosystem health. In the context of business ecosystems the term has been used to describe a dominant firm around which ancillary firms co-evolve [11]. Keystone organisations are critical to the maintenance of relationships within business ecosystems. They play a role in helping to “enhance stability, predictability, and other measures of system health by regulating connections and creating stable and predictable platforms on which other network members can rely” [11, p.9]. Iansiti and Levien [11] used the software sector as an example and postulated that keystone organisations are the driving forces behind software ecosystems, and provide stability in an otherwise unstable environment. Studies that use the keystone concept also argued that keystone organisations are likely to dominate the development or control the diffusion of innovations [9, 13]. As a consequence of their position in an ecosystem, keystone organisations (e.g. Walmart and Microsoft) can determine the characteristics of the ecosystem, establishing standards and providing platforms: services, tools, or technologies that members of the ecosystem can use to define their role [12, 15].

Co-Evolution
An ecosystem is characterised by competition and cooperation [19]. Just as organisms compete for limited resources (e.g. food, water, and energy), firms also compete for limited resources (e.g., customer demand) [31]. Moore [(25) and Lewin and Regine [18] noted that collaboration between firms or even between competitors is relevant to the stability and healthiness of a business ecosystem. Lewin and Regine [18] challenged the usual focus on competition and survival of the fittest and argued that the idea of head-to-head competition is of limited value in an increasingly networked economy. They advocated a shift in focus from one in which relationships between firms are emphasised to one in which relationships between ecosystems are considered.

Co-evolution is a common feature of ecosystems [22]. It is the process by which entities change together so that each creates a context for others [25]. In a biological ecosystem, each organism evolves in response to the evolution of others; but such processes are also a normal part of industry: manufacturers and ancillary industries change together over time [18]. In business, co-evolution can be seen as “reciprocal cycles of adaptation among one or more elements of an economic system” [26, p. 32]. As a result of co-evolution “Firms do not stand by themselves... For an industry with special input and skill needs, growth and effectiveness is strongly conditioned by how rapidly and effectively a support structure grows up” [28]. A firm’s ability to adapt to the environment and align its business objectives and strategies well with those of a key player (i.e. a keystone organisation) and other parts of a business ecosystem is thus critical in determining whether it can operate effectively within and outside the ecosystem [27].

Limiting Factors
In the above discussion on co-evolution it was observed that both organisms and firms compete for limited resources. The strategies that evolve for optimising access to and use of such resources help to determine the nature of an ecosystem and the interactions within it, and it could be argued that ecosystems are defined by the relationship of their component parts to limiting factors.

Processes of life require essential resources; and for them to continue, each resource must be available at a level above a biologically determined minimum. Blackman [2] observed that the resource closest to the minimum is the one most likely to limit growth and development. In a food chain, an organism, itself may be a limiting factor, with organisms at the top of a food chain relying on those lower down in much the same way as customers rely on materials in a supply chain.

One obvious limiting factor in natural ecosystems is energy. Madden [21] describes energy as “the currency of life” because, in biology, it is the most fundamental limiting factor. All living things have evolved systems that help to address three basic questions relating to energy [21]:

- Where can the energy needed to stay alive be found?
- How can it be stored?
- How can use of energy be reduced?

If the idea of defining ecosystems by limiting factors is extended beyond a specifically biological context, an ecosystem could be regarded as consisting of

- at least one limiting factor (eg, time, money, fuel, equipment etc),
- a physical environment,
- inter-relating users of the limiting factor(s).

This being the case, the above questions relating to energy could be applied to other limiting factors, with the inter-relating users
co-evolving interactions based on relationships to the limiting factors and solutions to the problems of how to get them, how to keep them and how to use them. All of these are relevant to the consideration of supply ecosystems.

**SUPPLY ECOSYSTEMS**

There has been a significant change in market dynamics since the late 1990s: a shift from supply push to demand pull [8]. One consequence of this shift is that any company attempting to succeed on its own has proved to be limited in terms of creating values for a customer-centric market [15]. As a result, some have argued that the supply chain model should give way to a supply ecosystem model which permits firms to work together to create new values [8, 14, 15, 19].

Supply ecosystems have been defined as sets of “interdependent and coordinated organizations that share some common adaptive challenges and that collectively shape the creation and nurturing of a sourcing base that contributes to competitive advantage and superior performance” [14, p.166]. They can be regarded as extended supply networks consisting of “vast loosely coupled networks of organisations and fraught with a variety of problems ranging from deep information and incentive asymmetries to the imperfect quality of information” [12]. Where traditional supply chain models focus on dyadic buyer-supplier relationships, a supply ecosystem model emphasizes multilateral collaborative relationships among loosely interconnected firms.

Understanding of ecosystems varies according to spatial scale [39]; similarly the scope of a supply ecosystem can be broad and focused on an entire sector or economy, or narrow and focused on particular value added activities (e.g. logistics, inventory management). The scope of a supply ecosystem can also be specific to a firm focusing on its relationships with other firms and the environment. Supply ecosystem analysis can include those firms that fall outside the traditional supply chain analysis but directly contribute to the value creation process [12].

A keystone organisation is the anchor of a supply ecosystem. Its requirements promote the evolution of platforms – services, tools, or technologies – for ancillary companies to use; and companies linked to the platform usually align their own objectives and activities not only to the keystone organisation’s but also to those of other companies in the ecosystem.

The relationship between the keystone organisation and its ancillaries is shaped by information. Wal’Mart’s procurement system provides its suppliers with real time information on customer demand and preference; Apple’s devices (e.g. iPhone, iPad, and iPod) allow software companies to create programmes for a defined market; and Toyota’s just-in-time procurement system provides real time information to suppliers regarding the inventory level at Toyota enabling them to plan their own production. Where a supply ecosystem has evolved around a keystone organisation, that organisation holds the power to shape the fate of other organisations within the ecosystem. This is especially true where resources can be substituted or where new firms are seeking a niche within the system.

Information is used to coordinate and control value added activities. Efficient information flows improve decision making and help to reduce waste and to increase efficiency; but information is a limiting factor that has profound effects on the health of a firm and the nature of a supply ecosystem. Thus, firms need to determine what information is needed, how to obtain it, and how to use it [15].

Traditionally, attempts to optimize the use of limiting factors in a supply chain relied on predictive models that took an overview of the value added process. Milgrom and Roberts [24] for example, argued that modern manufacturing involves closely coordinated changes in the overall business processes, rather than small adjustments. Biology by contrast, relies on small, timely adjustments that occur when components of the system respond to changes that they sense in their environment. Making timely adjustments to respond to the environment is difficult in traditional supply chains because accurate real time information is not always available. Figure 2 illustrates information and material flows in a conventional supply chain. Information is only communicated between adjacent links in the chain. Such linear information flows restrict real time information causing adjustments to be based on limited information. This results in lags in decision making, affecting timing of delivery and maintenance of stock level. The resulting amplification of errors, or bullwhip effect, can thus be characterised as informational problem caused by conventional predictive supply chain models [10]. A typical example would occur when a retailer receives a large order from a single customer and increases the next order to its supplier. The supplier (one level along in the supply chain) interprets the adjustment as indicating a growth in the market and orders more from its distributor. Similar conclusions by that and other distributors would lead to excesses in inventories along the supply chain.
INTERNET OF THINGS AND SUPPLY ECOSYSTEMS

To alleviate informational problems in supply chains, inter-organisational systems (IOS) have been adopted for operational improvement and information sharing [17]. Electronic data interchange (EDI) and enterprise resources planning (ERP) are typically used to facilitate connectivity and integration of data and information between trading partners. This improves order processing and reduces lead times for manufacturing and logistics [10]. However, since most IOS are based on linear supply chain logic they tend to focus on facilitating data and information exchanges between two trading partners. IOS designed for supply ecosystems would need to focus on multilateral relationships. These are non-linear and happen simultaneously, so such an IOS would need to facilitate communication of data and information between multiple firms. In addition, it would also need to recognise that firms can, when optimizing the use of limiting factors, be both competitors and collaborators.

The interaction between the people, process, data, and things that make up the IoT can make a significant contribution to non-linear informational problems of this kind. As Kim et al. [15, p.154] point out “a healthy information flow is an indication of a healthy ecosystem”. The smart technologies of the IoT are able to automatically capture, store, and disseminate data in near real-time, giving them the potential to maintain a healthy information flow that can facilitate and coordinate supply chain activities.

One of the key technologies of the IoT is Radio-frequency identification (RFID). Unlike the Universal Product Code with which firms can record the movement of goods by scanning them, RFID can track them without scanning, reducing time lags caused by gaps between scans. Furthermore, since modern RFID tags can be written to, data relating to the history of the goods, from production to purchase, can be recorded and accessed by authorized bodies [36]. While RFID has value in such backroom operations, other IoT objects have a role in other areas. Digital shelves for example, can be used in store to capture real time information about stock levels and i-Beacon can be used to capture consumer interaction with goods at the same time as pushing information to consumers.

Though IoT technologies can capture and distribute near-real time data, the issues of who can access the data and how much can be accessed, are a concern to many people. The existing IOS literature suggests that rights to access usually depend on the power relation between two trading companies [3, 33, 34]. In the case of supply ecosystems, keystone organizations may have a role in regulating information flows. This could be achieved through the provision IoT platforms (including services, tools, and technologies) that allow ancillary organisations timely access to the data needed for their decision making. The key function of the platform would be to make real time data available to members in order to alleviate informational problems. Figure 3 is a high level diagram which depicts an IoT platform for a supply ecosystem provided by a keystone organisation. The platform connects objects and feeds real time data about production events on the shop floor to an enterprise planning system within the keystone organisation that generates information for decision makers within and beyond the organisation. The platform also allows access to real time information about sales from retailers and possibly directly from consumers. Thus, a multilateral information flow can take place, instead of the rigid and linear flows that traditionally inform supply chain decisions.

Figure 2. Optimised supply chain management

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The IoT and its technologies have the potential to play significant roles in supply ecosystems. As a network of objects, data, people, and process the IoT concept coincides with the idea of supply ecosystems which are networks of loosely interconnected entities whose performances affect one another’s. In traditional inter-organisational systems, the focus is mainly on one-to-one relationships between two trading partners. By contrast, the IoT has the potential to connect information and to coordinate the activities of multiple parties, hence reducing informational problems caused by lack of, or delay in, bilateral communication.

There are, however, challenges that may limit the potential of the IoT in the context of supply ecosystems. Firstly, issues affecting standardization and interoperability may hinder connectivity and communication, preventing the capture of some real time data. Secondly, negotiating who has access to what information remains problematic. Thirdly, the large volumes of data generated by the IoT pose a challenge for most organisations wishing to explore and exploit the data at hand. Fourthly, legal issues such as privacy and commercial confidentiality remain major concern for both organizations and consumer. Finally, the seamless integration between internal information systems and an IoT platform will be a challenge, not only for the keystone organization that provides the platform, but also for ancillary organisations, which may be parts of a number of different supply ecosystems at the same time.

The IoT may have a significant role in reducing the informational problems associated with supply ecosystems. However, in order to utilize IoT technologies, organisations will need to change the way in which they perceive information flows, relationships within a supply ecosystem, and the nature of competition.

REFERENCES


UNDERSTANDING VIRAL ADVERTISING PASS-ON BEHAVIOR ON FACEBOOK
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ABSTRACT
This study aims at investigating Facebook users’ advertising pass-on behavior with self-disclosure and attitude toward online advertising. With about 350 undergraduate students’ responses, the results indicate that self-disclosure relates to attitude toward online advertising but does not link with pass-on behavior; attitude is the key mediator in the whole advertising pass-on process. This study extends the viral advertising pass-on model proposed by Chu [1], which provides significant implications for online marketers who have major purposes for adopting social-media marketing.

Keywords: Facebook, self-disclosure, attitude toward online advertising and viral-advertising pass-on.

INTRODUCTION
Facebook was founded in 2004 and was the first social network that surpassed 1 billion registered accounts [2]. Upon the second quarter of 2015, it had 1.49 billion monthly active users [2]. It has attracted vast groups of users in the world. Several scholars (e.g., [3] [4]) have pointed out retaining social groups is related to social capital theory—the resources embedded in one’s social networks and that can be achieved by information diffusion (e.g., [5] [6]). Particularly, Facebook groups provide a place for users to group together and share information secretly [1]. A lot of users perform personal updates and share information with others, such as news and advertisements, as parts of their daily lives. Hence, self-disclosure is a key means to cultivate and strengthen interpersonal relationships within social groups.

On the other hand, countless marketers have deemed Facebook as the most indispensable platform for social media marketing (SMM), which is “the umbrella term for the wide variety of tools and applications that give the Web its social capabilities” (p.75) [7]. Numerous studies have supported the benefits of adopting SMM to create more interaction, target communication, and spend fewer promotion costs (e.g., [8] [9]). Thus, many marketers integrate their current marketing plans with updates of their corporate Facebook pages and/or adopt Facebook’s advertising system to send more focused messages to particular groups of customers. The Facebook group page is revealed as one of the key marketing tools for enhancing brand awareness and communicating with customers.

This study aims to investigate the relationships of self-disclosure, attitude, and online advertising responses for a group of college-aged Facebook users, with reference to the research of Chu [1]. However, this study is different from her research in three ways. First, this research will integrate other studies (e.g., [10] [11]) to measure self-disclosure and attitude as to examine whether different measures of the variables also have similar findings. Second, it will investigate all the variables in one structural model as to examine the viral advertising pass-on model further. Lastly, it will examine the mediation effect of attitude and then illustrate the impact of attitude.

THEORETICAL BACKGROUND AND HYPOTHESES DEVELOPMENT

Social Capital Theory
The dictionary definition of capital is “wealth in the form of money or property owned by a person or business and human resources of economic value” (Oxford, 2000). Several scholars have described social capital as relational resources embedded in relationships (e.g., [12] [13]); for example, Granovetter’s [6] discussion of information diffusion as a kind of relational resource. People communicate with others and continue to disclose about themselves so as to convey meanings and concepts of "the self, of the family, of status, of nation, of world" (p.121) [14]. Those disclosures reflect the values and turn out to be social capital in maintaining people’s social groups. Marketers’ advertisements may be the contents to discuss online when they match with people’s personal perspectives. Mick and Buhl [15] added that advertisements were subjectively experienced amid people’s “history (past, current, and projected) and sociocultural milieu” (p.317). Taylor et al. [16] then reminded that practitioners should mindfully develop advertising to targeted viewers to express their identities, thoughts, and perspectives through forwarding behaviors.

Viral Advertising Pass-on Model
Online advertising allows viewers to have more control to access, like, comment, and share, thus changing the ways people respond to advertising [17]. Amongst different SNSs, Facebook is regarded as a favorite social media platform for online advertisements. Marketers spread messages and advertisements to potential consumers on Facebook, thereby aiming users to pass along advertisements to the others. Viral advertising is then created and regarded as “unpaid peer-to-peer communication of provocative content originating from an identified sponsor using the Internet to persuade or influence an audience to pass along the content to others” (p.33) [18]. Several researchers (e.g., [19] [20]) have investigated the ways to enhance Facebook users’ passed-along behaviors. Chu [1] proposed to investigate viral advertising pass-on behavior with the psychological factors of self-disclosure and attitude. She explained that users, particularly those who were members of Facebook fan groups, had higher tendencies for self-disclosure and more favorable attitudes toward advertising; furthermore, they were more likely to pass along...
advertising within their social groups. She remarked that Facebook’s college-aged users were the largest growing group on Facebook, and they had greater tendencies to pass along online advertising. With reference to her research, this study examines the relationships of self-disclosure, attitude toward online advertising, and advertising pass-on behaviors. A proposed research model is suggested in Figure 1.

Figure 1. Proposed model

Self-disclosure. Self-disclosure refers to “any message about the self that a person communicates to another” (p.47) [21]. It also relates to voluntary and intentional expression of one’s own thoughts, ideas, feelings, and experiences [10]. Mostly, Facebook users update their own information, such as hobbies and relationship status. They also share news and links to specific campaigns with others. These kinds of self-disclosure are important in an online context, as these are the ways to maintain relationships [22] and core social network behaviors [23][24].

Chu [1] explained, “Facebook group members are more likely to disclose their personal data on Facebook than are nonmembers. This finding is not surprising; group participation and engagement in viral advertising necessitates high levels of self-disclosure, because users explicitly exhibit connections with groups and endorse brands when they pass on viral advertising to their contacts” (p.39) [1]. She also illustrated that college-age users were more likely to have positive attitudes toward online advertising and perform advertising pass-on behaviors when they tended to have higher levels of self-disclosure. Zeng et al. [25] gave an explanation that self-disclosure related to users’ identities, and sharing advertising was a way to reflect their own perspectives, thereby enhancing their likelihood to accept viral advertising. Marketers’ advertisements may turn out to be contents for communications based on users’ personal perspectives. Hence, it is believed that those who are more willing to self-disclose may form more positive attitudes toward online advertising and/or have greater interest in forwarding particular online advertisements to others. Two hypotheses are set as follows:

H1: Those Facebook users who have higher tendencies for self-disclosure will form more positive attitudes toward online advertising.

H2: Those Facebook users who have higher tendencies for self-disclosure will perform more advertising pass-on behaviors.

Attitude toward online advertising

The theory of reasoned action (TRA) was proposed by Fishbein and Ajzen’s study in 1975, which highlighted the importance of attitude toward a particular behavior. Attitude is described as “a learned predisposition to respond in a consistently favorable or unfavorable manner with respect to a given object” (p.6) [26]. It is widely used for predicting a person’s adoption of innovative products [27]. With reference to TRA for online social-media marketing, attitude toward online advertising is treated as an important factor in affecting Facebook users’ advertising pass-on behavior. Facebook users who have favorable attitudes toward advertisements will read, like, click and/or play, whereas those who have unfavorable attitudes will ignore and/or even dislike any online advertisements [28]. This study infers that attitude toward online advertising relates to advertising pass-on behavior and performs as a mediator in the research model. The proposed hypotheses are as follows:

H3: Those Facebook users who have more positive attitudes toward online advertising will perform more advertising pass-on behaviors.

H4: Those Facebook users’ attitudes toward online advertising will mediate between self-disclosure and advertising pass-on behaviors.

RESEARCH METHODOLOGY

Sampling and Procedure

An English questionnaire was prepared with the purposes of the survey and was distributed during lesson breaks in different
courses at one university in Hong Kong. The undergraduate students filled in the questionnaire voluntarily. As a result, there were 356 returned questionnaires. Of the returned questionnaires, 345 sets of data were taken for this survey, as 11 questionnaires were more than 50% incomplete. Amongst the respondents, 111 (32%) were male and 234 (68%) were female. They were aged between 20 and 25. All of them had Facebook accounts.

Measures
All of the measurement items were based on the related literature studies. Four items for self-disclosure were taken from the study of Krasnova et al. [10]. The example is: “I keep my friends updated about what is going on in my life through Facebook.” Regarding measuring attitude toward online advertising, three items were adopted from the research of Sun and Wong [11]; for instance, “I would describe my overall attitude toward online advertising very favorably.” There were four items used to measure advertising pass-on with reference to the study of Chu [1]; for example, “I would consider passing along viral advertising to someone I know.”

DATA ANALYSIS AND RESULTS
Two steps of structural equation modeling (SEM) with SmartPLS 3.0 were performed. The dataset was first evaluated with a measurement model investigating the relationships of variables to latent variables whereas the second assessment was tested with a structural model for exploring the proposed model and the research hypotheses.

Evaluation of Measurement Model (Outer Model)
There were three assessments in this part: reliability and convergent and discriminant validity. The findings are summarized in Tables 1 and 2. Regarding reliability, both composite reliabilities and Cronbach’s alpha for the three constructs were all above 0.7, thus reaching the recommended criteria [29]. With regard to the assessment of validity, the factor loading of each item was above 0.70 and each construct’s AVE was higher than 0.50, thereby indicating adequate convergent validity [30]. In addition, the square root of the AVE of each construct was greater than its inter-construct correlations, and this indicated the measurement model possessed discriminant validity.

<p>| Table 1. Quality criteria of the constructs |</p>
<table>
<thead>
<tr>
<th>Latent Variable</th>
<th>Item</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Standardized Outer loading</th>
<th>AVE</th>
<th>Composite reliability</th>
<th>Cronbach’s alpha</th>
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</thead>
<tbody>
<tr>
<td>Self-disclosure</td>
<td>SD1</td>
<td>2.53</td>
<td>0.905</td>
<td>0.718</td>
<td>0.615</td>
<td>0.864</td>
<td>0.791</td>
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<td></td>
<td>SD2</td>
<td>2.76</td>
<td>1.020</td>
<td>0.806</td>
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<td></td>
<td>SD3</td>
<td>2.60</td>
<td>0.992</td>
<td>0.785</td>
<td></td>
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<tr>
<td></td>
<td>SD4</td>
<td>2.61</td>
<td>0.994</td>
<td>0.823</td>
<td></td>
<td></td>
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<tr>
<td>Attitude toward online advertising</td>
<td>ATT1</td>
<td>2.45</td>
<td>0.961</td>
<td>0.808</td>
<td>0.641</td>
<td>0.842</td>
<td>0.717</td>
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<tr>
<td></td>
<td>ATT2</td>
<td>2.40</td>
<td>0.913</td>
<td>0.858</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>ATT3</td>
<td>3.12</td>
<td>1.048</td>
<td>0.731</td>
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<tr>
<td>Advertising pass-on</td>
<td>APO1</td>
<td>3.08</td>
<td>0.919</td>
<td>0.803</td>
<td>0.681</td>
<td>0.895</td>
<td>0.846</td>
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<tr>
<td></td>
<td>APO2</td>
<td>3.33</td>
<td>0.883</td>
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<td>APO3</td>
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<td>0.860</td>
<td>0.821</td>
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<td></td>
<td>APO4</td>
<td>3.06</td>
<td>0.916</td>
<td>0.858</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

| Table 2. Square root of AVE (diagonal elements) and inter-construct correlations |
|-----------------|-----|-----|-----|
| Latent variable | SD  | ATT | APO |
| Self-disclosure (SD) | 0.784 |     |     |
| Attitude toward online advertising (ATT) | 0.453 | 0.801 |     |
| Advertising pass-on (APO) | 0.306 | 0.489 | 0.825 |

Evaluation of Structural Model (Inner Model)
Three processes recommended by Hair et al. [30] were used. The first step performed a collinearity assessment with a variance inflation factor (VIF). The VIF of self-disclosure and attitude toward online advertising to advertising pass-on were 1.259 and 1.258 respectively, which were below the threshold of 5. The second step was to adopt bootstrapping procedure (5,000 samples, no sign-changes option) to test the research hypotheses. The results are shown in Table 3 and Figure 2: Two proposed paths (H1 and H3) were supported (i.e., SD→ATT and ATT→APO). One unsupported path (H2) was found (i.e., SD→APO). The last process was to evaluate the predictive power of the model with R², f² and Q². The R² of two constructs—ATT and APO—were 0.206 and 0.248, which showed moderate predictive power [31]. As shown in Table 3, f² of three paths ranged from 0.012 to 0.259. Two paths (i.e., SD→APO and ATT→APO) were with medium-effect sizes. For Q², the model was evaluated with a blindfolding procedure [32]. The cross-validated redundancy values for the endogenous construct (VA: 0.155) illustrated that the model fulfilled medium predictive relevance.
Mediation Analysis

Attitude toward online advertising was the key mediator in this study and a mediation test was performed with bootstrapping for obtaining path coefficients between different constructs. With the Sobel Test, the estimate illustrated that attitude possessed full mediation effect between self-disclosure and advertising pass-on. The mediation test findings are depicted in Table 4. In summary, there are three supported hypotheses in this study (H1, H3, and H4) and one unsupported hypothesis (H2).

**Table 3. Significance testing results of the structural model path coefficients.**

<table>
<thead>
<tr>
<th>Path</th>
<th>Std. Beta</th>
<th>SE</th>
<th>t-value</th>
<th>p value</th>
<th>Sign.</th>
<th>f²</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1</td>
<td>Self-disclosure → Attitude toward online advertising</td>
<td>0.453</td>
<td>0.049</td>
<td>9.196</td>
<td>0.000</td>
<td>***</td>
</tr>
<tr>
<td>H2</td>
<td>Self-disclosure → Advertising pass-on</td>
<td>0.107</td>
<td>0.059</td>
<td>1.813</td>
<td>0.070</td>
<td>n.s.</td>
</tr>
<tr>
<td>H3</td>
<td>Attitude toward online advertising → Advertising pass-on</td>
<td>0.440</td>
<td>0.055</td>
<td>8.014</td>
<td>0.000</td>
<td>***</td>
</tr>
</tbody>
</table>

**Note:** Std. Beta = Path Coefficient; SE = Standard Error; Sign. = Significance (***p<.001); n.s. = non significance

**Figure 2. Results of the proposed model**

**DISCUSSION**

This study illustrates that self-disclosure and attitude are the key factors in the advertising pass-on behavior process. First, this study adopts different measures of the constructs (i.e., self-disclosure and attitude) from other studies, and the research findings are similar to the study of Chu [1]. This shows that her viral advertising pass-on model is applicable. This provides a major contribution to advertising forwarding behavior study.

Moreover, before getting Facebook users’ advertising pass-along response, marketers should formulate more strategies to induce users’ self-disclosure (if possible on their fan pages) so as to formulate more positive attitudes toward their online advertisements. The more users disclose, the more likely they respond to online advertising. Hui et al. [33] recommended revealing more users’ personal preferences and background information and then providing more extrinsic and intrinsic benefits to them (e.g., self-enhancement and pleasure feeling). In addition, Taylor et al. [16] recommended, “Practitioners should mindfully develop advertising messaging, themes, and value propositions that enable the targeted consumers to express their identities through forwarding behaviors” (p.24). This illustrates that viral advertising does not mean sending the ad to everyone, but marketers need to perform some analyses of their targets. More detailed users’ analyses may assist the spread rate of advertising in specific social groups.

However, self-disclosure does not relate to advertising pass-along behavior directly. This may be because users still do not want to turn their Facebook pages into commercial pages. Marketers need to acknowledge that Facebook is for building and maintaining social relationships [34]; it is not primarily for receiving commercial messages. Users may have a particular sense of intrusion upon receipt of messages from marketers and in turn be reluctant to forward those messages to their social groups. Therefore, marketers need to pay attention to how to post related advertisements to users. Some users may not like to disclose their preferences and/or forward messages to others or receive commercial information. Marketers should then target those Facebook
users who have high levels of self-disclosure, but they should also notice whether users have positive attitudes toward online advertising, as attitudes also relate to their willingness to pass along viral advertising.

This study shows that attitude is a key mediator in the whole advertising pass-along process. Besides performing detailed users’ analyses, when marketers send advertisements to users, they should be concerned with permission marketing, as this would eliminate users’ negative feelings toward their e-messages/advertisings. In addition, marketers should use more specific encouragement and incentives, like tailor-made gifts and coupons, in order to cultivate positive attitudes toward their advertisements. This shows that although Facebook provides a unique platform to marketers for online advertisements, marketers should be aware that not all Facebook users conduct the same activities.

Limitations, Future Research, and Conclusions
Numerous limitations concerning this study need to be noted. First, the samples of this study only consist of undergraduate students from one university. The samples might not be representative of general Facebook users. More respondents from different walks of life are highly recommended. Second, this research design was cross-sectional and only showed one determinant for the attitude formulation process. More investigations with different factors are highly recommended (e.g., users’ personal background, preferences, and other online behaviors). In addition, there are many factors leading to self-disclosure, attitude, and pass-on behaviors. For example, researchers may involve more factors related to personality and brand perception, to assist marketers in knowing the ways to form viral advertising. Lastly, the research design of this study does not involve any particular advertising, and respondents only answered questions based on their general perceptions/beliefs. Specific advertising may assist respondents in providing answers that are more accurate. Further studies may consider this arrangement.

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USER RESPONSE TO APP INSTALL ADVERTISING:
THE ROLE OF AD SKEPTICISM
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ABSTRACT
Mobile advertising is the fastest-growing format in the digital advertising market along with the rapid proliferation of mobile devices. Among various types of mobile advertising, app install advertising is said to be the driving force of this growth. Since mobile app markets, such as Google Play and Apple App Store, hardly provide the function for discovery of new apps or the recommendation of the right apps for users, app install advertising is considered an essential tool for making new apps stand out among the millions of apps in mobile app markets. Some studies have shown that users’ skepticism toward advertising, defined as the tendency toward disbelief of advertising claims has influence on advertising effectiveness. Other studies also have examined effects of users' dispositions such as prior brand attitudes, demographics and lifestyles, and product involvement. In addition, incentivizing app users, that is rewarding users for interacting with or responding to advertising in their mobile apps can also influence their response to advertising. The present study showed the positive relation of consumers’ personality traits and consumption experience to their ad skepticism against app install advertising. The influence of consumers’ ad skepticism on their response to advertising (app download intention) as well as the moderating effects of reward were also investigated.

Keywords: ad skepticism, mobile advertising, app install ads, rewards

INTRODUCTION
Mobile advertising is the fastest-growing format in the digital advertising market in 2015, and app install advertising, in particular, is said to be the driving force of this growth [5]. They are considered an essential tool for making new apps stand out among the millions of apps in mobile app markets such as Google Play and Apple App Store; the sheer number of available apps hampers users’ discovery of new apps and the recommendation of the right apps for users. To mobile ad platforms, including Facebook, Twitter, and small ad network companies, app install ads are attractive because such ads enable them to charge higher prices unlike with other ad formats. Previous studies have shown that users’ skepticism toward advertising, defined as the tendency to disbelieve the informational claims of advertising [10] have influence on advertising effectiveness. Other studies also have examined effects of users' dispositions such as prior brand attitudes, demographics and lifestyles, and product involvement. In addition, incentivizing app users, that is rewarding users for interacting with or responding to advertising in their mobile apps can also influence their response to advertising. Adapting Obermiller and Spangenberg’s Skepticism Toward Advertising Framework, the present study investigates the antecedents of users’ skepticism toward app install advertising and how skepticism influences their affective response (attitude toward the advertised app) and conative response (app downloading behavior) to advertising. The moderating effects of rewards is also examined.

LITERATURE REVIEW
Mobile Advertising
Growing number of researchers are investigating the effectiveness of mobile advertising and the factors that influence the effectiveness. Tsang et al. (2004) investigated consumers’ attitude toward mobile Short Messaging Service (SMS) advertising and its relationship with their behavior and found a direct relationship between consumer attitudes and consumer behavior. They also argued that most consumers have negative attitudes toward mobile advertising if they have not consented to the advertisements. Bart, Stephen, and Sarvary (2014) analyzed data from a large-scale field experiment and found that mobile display advertising increases users’ favorable attitude and purchase intention only when the advertised products are both high-involvement and utilitarian. Poels et al. (2013) investigated the attitudes toward in-game advertising, and found that the hedonic characteristics of in-game advertising has positive relationship with consumers’ attitude toward the in-game advertising. Besides, Beliefs that in-game advertising tends to lower the price of games has a positive relationship with attitude, while beliefs that in-game advertising fosters materialism has a negative relationship with attitude.

Skepticism Towards Advertising
Ad skepticism is the tendency toward disbelief in advertising claims and is a consumers' characteristics which have effects on advertising effectiveness [10]. Consumers, in general, have skepticism against advertising claims [9], and consumers who are more skeptical of advertising are more likely to dislike advertising.

There are a number of studies which proved that consumers are skeptical of advertising messages. Calfee and Ringold (1994) argued that about 70% of U.S. consumers are skeptical of advertising messages even when they think they can obtain valuable information from the advertising. Also Koslow (2000) found that consumer are skeptic again the advertising messages even when it is highly persuasive and apparently truthful.

Obermiller and Spangenberg (1998) also suggested that skepticism against advertising messages is related to other beliefs about advertising and also attitudes toward advertising. Also, after reviewing the items in attitude toward advertising scales they argued that ad skepticism and attitude toward advertising are related but separable constructs.
Antecedents of Ad Skepticism
We adopt Obermiller and Spangenberg’s (1998) proposition that personality traits and consumption experience are two main antecedents to consumers’ skepticism toward health claims. According to the model, ad skepticism results from basic personality traits such as self-esteem and cynicism and also their consumption experiences which may be influenced by age and education.

Personality traits
Increases in intelligence and self-esteem increases knowledge and counter arguing, and thus result in resistance to the advertising messages [10]. This is indistinguishable from ad skepticism and has negative effects on advertising effectiveness. It is assumed that people with cynicism are more likely to be more skeptical of advertising messages and less likely to believe the advertising claims. Thus, cynicism should have a positive relationship with ad skepticism. At the same vein, it is argued that people with cynicism are less likely to believe information from any source and more likely to attribute advertising messages to the motivation to persuade consumers to buy advertisers’ products and service [6]. It is also assumed that skepticism against advertising messages is learned based on socialization and experiences [10]. We propose the following hypotheses based on the preceding discussion.

H1: Consumers with higher self-esteem are more skeptical against advertising messages
H2: Consumers with more cynicism are more skeptical against advertising messages

Consumption experiences
Consumer’s consumption experience, including education and age, has positive effects on their skepticism against advertising messages [10]. They also argued that consumers' resistance to the advertising messages is the result of low yielding rather than poor reception. Since consumers with higher educational background tend to search and understand more, it can be expected that consumers with more educational background and more age to be more skeptical against advertising messages [13]. On the basis of the discussion, the following hypotheses are proposed.

H3: Consumers with more educational background are more skeptical against advertising messages.
H4: Older consumers are more skeptical against advertising messages.

Consequences of Ad Skepticism and the Moderating Role of Rewards
According to Obermiller and Spangenberg (1998, 2005), ad skepticism has effects on consumers' responses to advertising. They also argued that consumers with more ad skepticism tend to pay less attention to the advertising and make more counterarguments, and thus not likely to respond to the advertising. In this study, we adopted Soo-Jiuan and Khai-ling’s moderated model (2007) to show the effects of consumers’ ad skepticism on their purchase intention. According to Balwise and Strong (2002), reward for responding to an advertisement is found to increase the response to the advertising. Based on the preceding discussion, we propose the following hypotheses.

H5: Consumers with higher ad skepticism have less app download intention after exposed to an advertisement.
H6: App download intention increases when consumers are rewarded for responding to the advertisement.

METHODS
Participants and Experiment Procedures
An online survey was conducted to test the stated hypotheses with 100 participants, which includes 50 males and 50 females ranging in age from 20 to 59. Participants were randomly assigned to one of the two conditions (app install ads with rewards vs. app install ads without rewards).

Measures
Self-esteem was adopted from Rosenberg's (1965) scale and measured by averaging the scores of three seven-point items (completely disagree - completely agree). The three questions were 1) I feel good about myself as a person, 2) I can do many things well, and 3) I am looking forward to my future. Cynicism measures were adopted from Soo-Jiuan and Khai-ling (2007) and the seven items were averaged to generate the cynicism score. The seven questions were 1) Most people tell a lie if they can gain by it, 2) People claim to have ethical standards regarding honesty, but few stick to them when money is at stake, 3) People pretend to care more about one another than they really do, 4) It’s pathetic to see an unselfish person because so many people take advantage of him, 5) Most people are just out for themselves, 6) Most people in fact dislike putting themselves out to help others, and 7) Most people are not really honest by nature. Skepticism was measured by averaging nine items proposed by to Obermiller and Spangenberg (1998). Three purchase intention questionnaire items were adapted from MacKenzie et al. (1986) and Anand and Sternthal (1990), and then revised to fit the context of mobile app install advertising. The three questions asked 1) the extent to which the respondent want to download the advertised app, 2) the extent to which the respondent would like to download the advertised app, and 3) the extent to which the respondent is likely to download the advertised app.
RESULTS

To test the hypotheses, a regression analysis was conducted with the survey data (Table 1). The results show that consumers' self-esteem was found to be positively related to ad skepticism, and this means consumers with higher self-esteem tend to have higher skepticism. Thus, hypothesis 1 is supported. Also Cynicism was found to have positive influence on ad skepticism and hypothesis 2 is supported.

According to the results, education level was found to be positively related to ad skepticism, and this means consumers with higher background tend to have higher skepticism, and thus hypothesis 3 is supported. Age has a significant effect on skepticism against advertising messages, and the positive coefficient means older consumers tend to have higher skepticism and hypothesis 4 was supported.

Table 1. Results of regression analysis

<table>
<thead>
<tr>
<th>Variable</th>
<th>Standard β</th>
<th>t</th>
<th>Sig.(p)</th>
</tr>
</thead>
<tbody>
<tr>
<td>self-esteem</td>
<td>0.13</td>
<td>2.32</td>
<td>0.046</td>
</tr>
<tr>
<td>cynicism</td>
<td>0.16</td>
<td>2.45</td>
<td>0.027</td>
</tr>
<tr>
<td>educational</td>
<td>0.18</td>
<td>2.44</td>
<td>0.036</td>
</tr>
<tr>
<td>age</td>
<td>0.11</td>
<td>2.93</td>
<td>0.035</td>
</tr>
</tbody>
</table>

The average of participants' ad skepticism was 4.13, and using this average score as a demarcation point, the participants were classified as low and high ad skepticism group. Then an ANOVA was conducted to test hypotheses 5 and 6. Figure 1 shows the relation between participants' ad skepticism and their app download intention, and also the moderating role of rewards. A significant main effect of ad skepticism on app download intention ($F(1, 96) = 8.70, p < 0.01$) and the interaction ($F(1, 96) = 8.07, p < 0.01$) emerged, and therefore H5 and H6 were supported. Consumers with higher ad skepticism against the advertising messages are likely to have less app download intention. In addition, it shows that when the participants are rewarded for responding to the advertisement, they are likely to have more app download intention.

CONCLUSIONS

In this study we aimed to investigate the antecedents of ad skepticism against app install ads and its influence on consumers' response to the advertisements (app download intention). Obermiller and Spangenberg's (1998) ad skepticism framework was successfully adopted in the context of mobile app install ads. Our study shows that consumers' personality including self-esteem and cynicism, and their experience including age and educational background, are found to have significant positive relationship with consumers’ skepticism against mobile app install advertising. It was also found that consumers with higher skepticism are less likely to download the advertised apps after exposed to the app install advertisement. In addition, this study showed that advertisers can increase consumers' response to app install advertising by providing them with rewards for responding to the advertisements, even in case of the consumers with high ad skepticism.

This study has a couple of limitations. First, 100 people participated in the survey, which is not a large enough sample size for the analysis, and additional research with a larger sample size could generate more robust results. Second, some variables that might be the important antecedents of ad skepticism were not investigated. By asking about their prior smart phone experience and mobile game usage patterns and including in the analysis, the results could have been more reliable.
REFERENCES


VALIDATION OF WEB SITE DESIGN
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ABSTRACT
Well-designed Websites are critical to the success of E-commerce. However, many websites do not show satisfactory level of usage. The construction, assessment, and improvement all are essential for the work of design. Most of the studies in the related literature only focus on one of them. There is lack of a framework to integrate them into a complete cycle. One central work is to validate the Web design to ensure to meet the design requirements and performance goal. In this paper, we propose an integrated framework based on concepts of transformation of system development process and formulation of design requirement. The validation of Web site level, similar to compiling and running time check, to authenticate design structure and anticipated performance. The research depicts a systematic and structural way to integrate the work of construction, assessment, and improvement for the design of Web. The integrated approach offers a complete-cycle framework on a continuous improvement basis. The research also sheds the light on several potential research topics to further explore interesting and sophisticated Web issues.

Keyword: Web Design, Assessment, Validation, Structure Modeling

INTRODUCTION
The fast-growing sheer volume of information and resources available on a website has made effective design increasingly critical. Central to website design is accessibility which allows visitors to locate and access targeted (interested) contents using a small number of clicks. In general, visitors are not particularly stick on websites. According to ATW [1], an individual typically accessed three or fewer pages in a visit. This non-sticky behavior, in turn, makes website design increasingly critical. The bottom-line is a visitor is likely to leave a website when he or she cannot access targeted or relevant contents within a limited number of clicks.

In spite of the prevalence of e-commerce, both researchers and practitioners have been greatly challenged by such fundamental questions as “how to design a good website” and “how to improve an existing website design.” These questions are critical for firms interested in offering e-channels to serve customers, launching new services, or engaging in e-branding. The design of Web site should take into account the needs of both designers and users. The construction, assessment, and improvement all are essential for the work of design. The construction itself is a transformation process starting from requirement elicitation to Web site creation. The assessment is to measure the quality of the Web site design. Based on the assessment result, expected result, and changes of requirements, the continuous process of review and improvement is imperative.

Web construction issue has been extensively studied from various aspects. Various construction guidelines were advocated in the literature, e.g. system functionalities [13] and human computer interactions. W3C (World Wide Web Consortium) provided various guidelines to improve the accessibility of Web content for people with disabilities [16]. Nielsen [11] proposed many guidelines on Web usability in the Alertbox.

Several papers studied Website assessment from classifying the key dimensions or aspects for system evaluation by summarizing the literature [3] [15] summarized the literature to propose a framework of twelve dimensions for evaluating Web applications. The evaluation can be form the aspects of Web content (e.g. features) [6] [14] and Web usage (e.g. usability) [5][7][8].

The improvement issue for Web applications has been studied in many different areas. For example, several papers discuss the personalization to ease the usage for the purpose of improvement [2] [10]; some paper focuses on by providing the navigation guidance and various cues to enhance system support [4] [12][19].

There are few studies on linkage or integration of stages. Matera et al. [9] introduced several principles for promoting web usability during the web application lifecycle. They also discussed three classes of usability evaluation methods, namely, user testing, usability inspection, and web usage analysis. Yen [20] proposed a framework of Accessibility-Popularity (A-P) model to investigate the A-P mismatch on both page-level and site level. Based on the evaluation result, general guidelines were given to balance A-P on all pages in a Web site. Yen et al. [21] proposed a framework to depict preliminary picture of process of design, evaluation, and enhancement. The framework is based on the classification of features of content and design, transformation of constraints and objectives, and four-parameters constraint table.

The literature review above suggests the need for a systematic and integrated approach of analysis, evaluation and enhancement for website designs. In particular, the use of rigorously defined structure and analytical models to investigate website design problems has been limited, if any at all. To a large extent, website design resembles the shelf management problem common to retailers and therefore can be formulated and model as an “optimization” problem. Compared with classic optimization problems, analysis of an
“optimal” website design needs to address additional challenges that include frequent/continuous content updates/changes and access behaviors of visitors co-determining “optimality.” Results from prior research highlighted the adequacy and appealing desirability of using graph theory to model and analyze Web related issues. However, most studies focused on particular graphs and lacked systematic analysis of the overall applicability of graph-based modeling in enhancing website design. In this research, we propose an integrated framework to synthesize the main processes of the Web design by validating the main work for requirement review and expected performance.

PRELIMINARIES

The previous work [21], as mentioned in the previous section, provided a preliminary framework about the integrated approach to model, evaluate and enhance the Web design bases on analytical structures. The main ideas include four-layer structure and three transformation processes between the layers as follow.

- **Four-Layer Structure.** (i) Application Layer: elicitation of application domain based requirements (e.g. features, functions) for design of Web sites; (ii) Generic Web Layer: problem formulation based on requirements as objectives and constraints; (iii) Graph Modeling Layer: analysis of problem in mathematical models; and (iv) Generation Layer: the desired output based on the requirement compilation, formulation and analysis.

- **Transformation Processes.** (i) **Characterization**: developing a framework for characterizing website applications and analyzing their respective specifications and requirements; developing the framework to classify and formulate design objectives and constraints from the aspect of both designers and users, and representing them using mathematical formulations; ii) **Classification**: developing the framework to synthesize and map website design models to appropriate graph problems; and (iii) **Consolidation**: developing criteria of bottlenecks identification and shift; developing tradeoff analysis of efficiency, utilization, and profitability; examining users’ perceptions and evaluative assessments; analyzing and comparing the difference between the expectation and perception and assessment as well as between the objective and subjective evaluations to generate insights on and recommendations for continued website design improvement.

The above framework summarizes the overall conceptual roadmap without completing the cycle in detail. There are two major questions to be addressed for Web design problem – (1) “does the design truly comply with the requirements (e.g. structural properties)” and (2) “whether the design can achieve the expected result (e.g. performance)”.

Using the programming as an example. The three main forms for programming are conceptual design, program, and application as shown in Figure 1. In the cycle, the compiling part is to ensure the correctness in the syntax and the runtime check is to test the whether the result or output is as expected. We move to the level of Web design as an example of system design or IS project, the main stages for the process are requirement analysis, system design, and system development as shown in the Figure 2. It is challenging to verify the design correctness, not mentioning the expected result. One common example is gap between user requirements and the delivered system for IS projects [22]. It is very challenging to do the similar thing as compiling and runtime check for program level. The Web design inherits the similar problem to come up a unified framework for Web construction, assessment, and improvement.
The integration of construction, assessment, and improvement is imperative for designing and managing Web application. The cycle of Web construction, assessment, and improvement is shown in Figure 3. In the literature, most of the studies focus on individual stage. However, very few of them cover the linkages between two stages, especially the complete cycle. One main challenge for the integration of three stages to form a complete cycle is due to the lack of unified framework for all three stages. One central piece is missing is to validate the Web design on both design requirements and expected performance.

The idea of validation has been adopted for various Web applications. However, it is limited to page-level technical analysis. For example, WordPress Codex defines validating a website is “the process of ensuring that the pages on the website conform to the norms or standards defined by various organizations” [18]; W3C Markup Validation Service define a validator is “a software program that can check your web pages against the web standards” [17].

At a nutshell, website design is, to some extent, one type of information system design which includes requirement analysis, functional design, and development. The validation of the design normally comes with compiling and running. The compiling result mainly shows the syntax related problems; Running time errors reflect more about the semantics issues. Web design also goes through similar process – requirement elicitation and analysis, conceptual design, and system development. The validation of Web design will be based on requirement in constraints and objectives, and Web structure properties. The process will include the transformation of the problem description to mathematical optimization classification together with justification on the usage result.

Objectives and Constraints

The identified features and additional requirements are consolidated and then transformed to objectives and constraints. Fulfilling the Web site design goals and requirements is critical. Both of the designer and the user have their own requirement of the Web site design. Some of their requirements are the same. For instance, they all want the download time for the Web site is as quick as possible and the content is as complete as possible so that the user can find whatever they want in a short period of time. However, some of their requirements are not the same. The designers may want, for example, the total transaction volume can be maximized, the Web site should be adapted to dynamic access behaviors of visitors and some agreement pages must be visited before a registration page. While the user may want that the cheapest product can be found as soon as possible, the Web site can be customized to the user’s taste and registration and certification can be done as soon as possible. Both requirements from designer and user can be defined as objectives and constraints.

There are a lot of design objectives, such as to minimize searching time for target product, to maximized relevant retrieved contents etc. The design constraints can be the loading time of one page, placing agreement pages before registration pages, etc. Furthermore, these objectives and constraints can be analyzed from different perspectives, for example, from designer’s and user’s point of view, or from user interface related, Web site structure related and Web site navigation related point of view. Similar to the classification of objectives of Web site design, the constraints can also be described accordingly.

Objectives and constraints can also be classified as one page related or the whole Web site structure related. In terms of one page, the objectives of the design could be minimizing the time loading the graphs on the page and providing limited outgoing links so that the page are not over crammed. In terms of the whole Web site structure, the objectives could be to provide optimal navigation guide, to maximize the accessibility of the Web site and to enable users to reach related information within limited clicks. In terms of one page, the constraints of the design could be centralizing the promotion category and highlighting the promotion information. In terms of the whole Web site structure, the constraints could be inter-page text similarity. Moreover, some page must be visited before some other page.
Problem Description And Formulation

The classification of Web navigation problem can be formed from various aspects. The following is the exemplary framework to illustrate the main ideas. The intention is not trying to provide a complete list of possible components. The framework only serves as a representative instance for explanation and explanation as well.

Here are four main categories in the classification dimensions – objective function, structural constraint, navigation requirement, and supporting resources.

- **Objective function (O).** It represents the problem orientation and the assessment goal, and normally reflects the objectives. There are four very common used assessment types for Web applications, namely search, spanning, sequencing (or scheduling), and flow. Searching related assessment functions are used for retrieval of one or more specific pages (nodes). One example is to find a shortest path (or time) to access a specific page. Spanning type is to traverse some or all pages at a site. Sequencing (or scheduling) type normally is related to decide the order of multiple retrievals for time minimization to other purpose. Flow type is to control or regulate the page accesses of multiple retrievals. Of course, there could be more types of problems to be included.

- **Structural constraints.** This mainly denotes the structure related properties which normally suggest the possible constraints for the problem to be investigated. It can include, for instance, structural category, cost of arc, and out-going degree. The details are as follows.
  - **Structure category (S)** describes Web structure, e.g. tree and directed acyclic graph.
  - **Cost of each arc (C)** denotes the overhead to access the page, which could be the function of page size or other important factor. There could be some considerations or constraints for the cost function, e.g. homogeneous / heterogeneous and symmetric / asymmetric.
  - **Out-going degree (D)** defines the possible number of pages to be connected to. There could be maximal or/and minimum numbers out-going links.

- **Navigation requirement.** It is concerned about the navigation related requirement which may include navigation setting and Sequence relationship.
  - **Navigation setting (N)** reflects navigation complexity from both start and destination possibilities. There could be multiple starting page and destination pages in navigation.
  - **Sequence relationship (R)** represents the constraints between pages, e.g. distance range.

- **Supporting resources (P)** refer to level of resource availability. Cache function is considered as one main supporting resource which can be constrained by size, time, or both.

These four dimensions, more or less, can depict the main description of Web navigation problems. Among these four dimensions, objective function and structural constraint are more fundamental than the other two (i.e. navigation requirement and supporting resources) in terms of the problem description. In other words, it is required to specify objective function and structural constraint for all the problems; however, navigation requirement and supporting resources are optional unless they are applicable. We may define each dimension (or sub-dimension) using alphanumeric codes or notations for the convenience to denote them. For example, please refer to Table 1. If there is no special needs for navigation requirement and supporting resources, then the default values will be (1,1) for navigation setting, no constraint for sequence relationship, and no cache for supporting resources, which can be omitted in the problem description.

<table>
<thead>
<tr>
<th>Objective Function (O)</th>
<th>Structural constraints</th>
<th>Navigation requirement</th>
<th>Supporting Resources (P) (cache)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Search</td>
<td>Tree</td>
<td>Identical</td>
<td>No Constraint</td>
</tr>
<tr>
<td>2 Spanning</td>
<td>Directed Acyclic Graph</td>
<td>Symmetrical Identical</td>
<td>Constraint on Upper Bound</td>
</tr>
<tr>
<td>3 Sequencing / Scheduling</td>
<td>Graph</td>
<td>Symmetrical Non-</td>
<td>Constraint on Lower Bound</td>
</tr>
<tr>
<td>4 Flow</td>
<td>-</td>
<td>Asymmetrical Identical</td>
<td>Constraint on Upper and</td>
</tr>
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Assessments and Improvement
Assessment, construction, and improvement are three of the major issues for Web design. Assessment methods of Web sites is regarding the evaluation for performance measures based on sites’ static (e.g. structure) and dynamic (e.g. flow) properties; construction is relevant to the approaches to creating and changing Web sites by taking into account various requirements or objectives; and improvement strategies concentrate on revision and enhancement subject to specific objectives and constraints. These three issues are closely related to each other and are essential in different stages and focuses in Web design. Assessment criteria are required for both construction and improvement issues. There are a lot of commonalities between construction work and improvement process.

The assessment of Web design is to evaluate the performance to reflect the current status, and to possibly provide the insights for further improvement. There are many approaches for Web assessment. For example, one approach is to investigate the correlation between the expected performance (accessibility) and actual result (popularity) [20] to identify the gap and adjust the accessibility to reflect or to change the popularity. In the literature, there is lack of linkages between the assessment methods and improvement strategies. Besides, both assessment and improvement are closely related to the logic of Wed design. Integrated framework to align design, assessment and improvement is imperative for the Web applications.

The assessment of Web design can be made in different stages and in various aspects of Wed application development. In the planning stage, the main focus of assessment is on syntactic view of design and in the execution (or running) stage, the assessment can be the performance evaluation against the theoretical optimality or practical benchmark.

- **Design review.** The design can be systematically reviewed to ensure the requirements are met and all the important issues (e.g. objectives and constraints) are addressed.
- **Model measure.** The evaluation is based on the comparison between optimal solution and actual result.
- **Benchmark test.** The evaluation is based on comparison between given expected performance and actual result.

We may assess and improve the Web designed from various aspects.

- **Accessibility.** One way is to investigate the correlation between the expected performance (popularity) and actual result (popularity). The improvement can be achieved by adjusting the accessibility to reflect or to change the popularity.
- **Gap.** Based on the problem classification, we can identify the gap between the theoretic result (optimal solution) and the actual usage average. The improvement can be achieved by either revising the objective (or constraints) to align the design to the user needs better, or enhancing the critical elements (e.g. highlighting the specific hyperlinks) to adapt users to the right track.

One exemplary improvement strategy is to shift bottleneck. The "bottleneck identification is one of the major tasks for analysis. The bottleneck pages have the high impact on the information access and navigation in the graph. There can be two levels of perception for assessment and improvement. At a micro level, we can analyze and obtain users’ perceptions based on the user log file. This perception can reveal the popularity of different pages and prominent paths all visitors or groups of visitors. At a macro level, we examine visitors’ perceptions about and satisfactions with the website design by surveying them immediately after their visits. These perceptions will be examined and categorized to generate insights into business strategies and essential new user requirements to be incorporated in the subsequent incremental website design process. The appraisal of the user’s perception is primarily based on the application categorization, usage association, and navigation analysis. We acquire users’ feedback and evaluative assessments and compare them with the requirements. We also compare the objective evaluations and corresponding subjective evaluation results. We then can be specific about the design aspects that users value (e.g. interface design vis-à-vis navigation design) as well as identifying the particular evaluation criteria matter most to them (e.g. page accessibility versus page loading time).

CONCLUSIONS
To bridge the gap between designer’s expectation and the user’ perception, website designers need a methodology to examine the general design requirements and analyze essential user requirements. In addition to key human factors, analysis and evaluation of website structure is critical cornerstone for design guideline. The validation of Web design is critical and challenging. The integration of construction, assessment, and improvement is imperative for Web design. The possible future directions include -

- To further enhance the problem classification by applying the proposed framework for different applications.
- To take into account the various usage data to explore more analytical implications.

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**The Fifteenth International Conference on Electronic Business, Hong Kong, December 6-10, 2015**

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To extend the application scope from individual and isolated Web site to include the the neighbors (i.e. connected Web sites).

ACKNOWLEDGEMENT

The research was partially supported by GRF grant (719409E) from the Research Grants Council, HKSAR.

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VISIBILITY CLOUD: A SUPPLY CHAIN PERSPECTIVE
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ABSTRACT
Visibility in a supply chain brings benefits across all partners, leading to positive effect on overall supply chain performance. IoT-based approach has been shown to be effective in enhancing end-to-end visibility. An IT artifact can be designed to deliver supply chain visibility to individual users. Yet, factors like ownership, costs, and know-how often deter the adoption by supply chains. In this paper, we present the design of a cloud-based IT artifact for supply chain visibility services. With IT services and a service-oriented approach to visibility, a concept of visibility cloud (VC) is proposed. The design objectives of VC are articulated, leading to two key services formulated as Visibility-as-a-Service and App-as-a-Service. The two services are described and followed by an illustrative instantiation. VC servicetizes SCV with affordability and expandability according to the pace of each individual party. With metered SCV services via mobile devices, supply chain management is effective definite (definite effective?) anytime anywhere.

Keywords: Supply chain visibility, IoT, Service, IT Service, Visibility Cloud

INTRODUCTION
Supply Chain Visibility (SCV) has been taunted as a game changer that will bring supply chain performance to the next level. Yet, the pursuit of visibility remains challenging with no tangible artifacts. Emerging technology though offers on-demand facilitation and data-rich embedded component to support the innovative design of SCV as do-it-yourself (DIY) pay-as-you-go (PAYG) IT services. The conceptual development of SCV with a cloud-based operationalization scheme is proposed in this study.

For obvious reasons, current status of any operations of a supply chain party is visible to the human eyes, at least within four walls. Such analog visibility, such as CCTV, does not precisely describe the situation, and the view requires interpretation with trained eyes. Digital visibility is possible given the right data is persistent in store and shared. Visibility involves two defining parties – the one who sees (or the see) and who be seen (or the seen). Value proposition from each often cannot take what the other party needs or has respectively into consideration. Only at service exchange, such proposition could be aligned, giving an effective SCV delivery – the seen has a continuously improving rich data pool with respect to business processes, and the see has a visibility requirement at the time of need articulated based on data availability.

Internet of Things (IoT), Internet connected objects embedded with sensors and/or actuators, adds identification and real-time data dimensions within supply chains. With IoT technology, the right corporate transactional data can be coupled with dynamic and real-time operational data that are attached to known entities. This added data dimension could be simply the on/off of the sewing machine in a production factory – a more precise level of detail, or that particular WIP item that just passed through the outbound exit door onwards to the warehouse across border – a wider net of data coverage. The identity of an entity as IoT data serves as an integrative glue to scattered corporate data. Benefits of RFID have been suggested and the technology has been implemented in supply chain and logistics management, and in other industries such as retail and healthcare.

IT as a service has revolutionized corporate IT strategy from ownership to PAYG services, from infrastructure (IaaS) to software (SaaS). Common definable procedural processes are well positioned to deploy as SaaS, executed in third-party owned IT resources & based on a pay-per-use cost model. Despite some data privacy and security concerns, metered IT services also offer fault-tolerant and optimization, especially critical to global e-merchants and social media sites where activity spikes are common and any downtime is unacceptable to the users.

In this paper, Design Science Research (DSR) approach is followed to offer a design of a cloud-based service-oriented artifact for SCV. Contributions takes in the form of a paradigm shift approach to SCV, which is not designed as a software component to buy and install, but is as a service that provides clarity and fidelity in supply chain management. SCV is enabled by the provision of an IT artifact in the cloud that delivers effective on-target and on-demand SCV for supply chains via services as mobile apps – the design artifact is termed VisibilityCloud (VC).

In the following section, literature on a number of keys concepts behind the service-oriented VC is discussed. Based on the interplay of these concepts, and a Visibility Platform (VP) artifact, a foundational premise is established. Description of our design attempt to formulate two new services of the VC, followed with an illustrative instantiation of a typical supply chain scenario via mobile apps. Concluding remarks on this work-in-progress research on mobile visibility service are given at the last section.
LITERATURE REVIEW

Adoption of RFID technology in supply chain management has been discussed [27, 5, 11, 12], with benefits shown to reduce shrinkage and create overall cost savings [24]. The IoT role in visibility of supply chains is also discussed with possible accuracy in stock level, and allows proactive reaction to information from upstreams or to downstreams (e.g., consumption point) [6]. Time-temperature monitoring in perishables moving from ambient chain to cool chain has been argued to reduce spoilage and maintain product availability [14].

Supply chain visibility brings obvious benefits based on articulated information sharing and availability [2]. The lack of supply chain visibility has been a top concern [7] and to gain a basic level of visibility one relies on packaged software such as Excel and in-house applications [8]. SCV involves the undeclared cooperation of two parties: the one that receives the visibility view for making a wise decision (the ‘see’), and the ones that ‘create’ the data (the ‘seen’) as information flow in the supply chain. The former is referred to a Wiser, and the latter as Maker in this paper – a duality of visibility that is crucial in any SCV design.

Based on different perspectives of supply chain visibility in the literature [22, 23], a number of characteristics are suggested – contextual in nature, and right information sharing such as product tracking. A definition of SCV for discussion is given: SCV is the availability of supply chain actionable status. Two dimensions of SCV are also declared: clarity and fidelity based on the general meaning of ‘visibility’ as how clear and how far one can see, and is also suggested as data quality dimensions [26]. SCV with clarity shows associated upstream and/or downstream information traces, while fidelity provides data comprehensiveness drilled down to the item level of supply chain entities. For the purpose of this paper, the breadth of information is used for clarity in following discussions, and depth for fidelity.

Currently, to the best of our knowledge, there does not exist a reference framework or models for guidance to bring visibility in supply chain management. An attempt is made to prescribe a framework, from the perspective of IoT, to gain visibility in a systemic way in an accompanying paper in this conference [16]. One example of an implementation of SCV facilitated in a Visibility Platform (VP) is described in [15], and a general view of the VP framework is based for a self-service extension.

There are a number of design science research approaches proposed in rigorousness and communication practice [9, 21]. In here, we follow the publication schema given in [10]. A thought process is described next before the artifact VC description is provided. Evaluation and discussion as concluding remarks will then follow.

Supply Chain Visibility: Services in a Cloud

Supply chain partners work together intellectually to contribute to overall performance as a whole. Interestingly enough, SCV should take on a service view accordingly to the inherent duality characteristics of visibility in general. Service-dominant logic is a view offered to overtake the traditional goods-dominant logic in marketing [25, 19]. Actors of the economy work together in a service setting to co-create value. In the context of SCV, the Wiser(s) and the Maker(s) work together independently to co-create value for the supply chain. SCV with clarity and fidelity brings improved performance overall and across individual partners. In the exchange of knowledge, each Maker knows specifically how data are to be generated and collected that are precise and crucial. Each Wiser knows how to make use of the available data to compose a visibility view with accuracy and currency that is effective in supporting a decision with high confidence level.

Such service in the physical world can be transformed into e-Service with collaborative efforts among all parties [4]. With a SCV envisioned by the Wiser, the delivery of the on-demand view can be a Party e-Service [3]. The concept of multiple parties participates in an e-Service that brings SCV to one or all involved is intrinsic. The clarity of a view is undoubtedly improved with collaborative efforts from participating parties. SCV for a warehouse manager on a SKU is much improved if during the composition of the view, the factory manager contributes his input on specific data availability, both corporate and IoT, and (one-time) permission for other in-depth information. The notion of collaborative e-Service positively influences clarity and fidelity of a SCV is warranted.

Technology with a service perspective continues to flourish such as service-oriented computing (SOC) [20] and cloud computing (CC) [1]. SOC studies the critical components that can be designed to enable services in an electronic web-based environment. With CC, metered IT services can now be obtained from software (SaaS) down to IT infrastructure (IaaS), allowing different service levels for delivery and performance of e-Services. Such development extends the service concept into IT services, e.g., IT computing environments are software-defined, or SDEs [17]. IT resources are configured on-demand with flexibility.

The notion of “services in a cloud” stems from a single concept: service. A broaden view of service innovation suggests frameworks of service ecosystems, service platforms and value co-creation [18]. Value co-creation is inherent in SCV. Mobile e-Service is the next frontier for SCV to reach [13].

SCV is a service-oriented exchange. The service is enabled in an electronic environment with a collaborative nature. The e-Service is deployed in the cloud environment. Service experience is via mobile devices. That is, SCV is a service exchange between collaborative supply chain parties in a cloud-based mobile environment. The design of an IT artifact is provided next to bring IoT-enabled SCV to the masses.
An IT Artifact: A RFID-Based Visibility Platform

A case scenario where a VP was implemented for an actual garment supply chain enabled in the design process with RFID technology is used as a starting point for SCV. Digital visibility is built with data, in which data is both generated and collected. Generation is often driven by business transactions. Targeted collection of data is enabled with IoT technology. A third element that would not be considered in this writing is data interpretation – social media data, part of a big data suite, are interpreted for SCV purpose with tools such as opinion mining and sentiment analysis. Social media data include mostly data sources that are not controlled by the respective supply chain.

Next, the IT artifact that forms a foundational premise for VC is briefly described. The RFID-enabled garment supply chain, referred to as ActiveWear, a fictitious name, in this paper with manufacture facilities located in South China and Hong Kong will be used.

Figure 1 depicts the design process of an artifact that enables visibility in a supply chain with the incorporation of IoT. IoT data is collected with pinpoint accuracy with respect to business processes driven by management actions. The VP is the IT artifact embedded into the operations of the supply chain, creating and integrating data and information for end-to-end visibility.

![Figure 1. Enabling Visibility with RFID of a Garment Supply Chain](image)

Given the design, a VP is built with acquired hardware and networking equipment distributed across all partners in the supply chain. The infrastructure and networking work requires expert domain knowledge and intensive testing as equipment specification standards and broadband communication service levels are different in Hong Kong and China.

The process begins with a charting of all supply chain business processes using the standardized tool SCOR (such as the Source, Make, and Deliver process components). With this supply chain business process (SCBP) map in hand, pain points are identified based on articulated management’s concerns and suggestions. RFID technology is then introduced at those points (shown as ‘traffic lights’) targeting directly the SCBP(s) to capture relevant data. With this new real-time data, a data pool coupled with corporate’s transactional data, is made available in the VP for the facilitation of visibility views’ creation. A reference framework is currently being developed for this process [16].

Operationalization of SCV is illustrated with the above case scenario. Next, a design approach is attempted to bring the service concept into supply chain visibility. That is, visibility services enabled in a cloud environment as apps deployed from the ‘app vault.’

**DESIGN ARTIFACT – VISIBILITY CLOUD**

Visibility is a double-edged dilemma – two asynchronous parties take on requirement that could very well be conflicting and even have an unreachable goal. The ‘seeing’ cannot foretell what the needed visibility is, and the ‘seen’ cannot tell what data constitutes a visibility ahead of the demand.

A Visibility Cloud artifact is designed to provide a visibility creation service via a configured VP provisioned for the supply chain, and a visibility activation service via a managed vApp (visibility app) store. SCV is a service achieved by an on-demand provision of a Visibility Cloud, inherent much of the cloud computing benefits from an enterprise IT strategic position perspective.
The creation service is defined as a Visibility-as-a-Service (VaaS) where visibility services of supply chains are enabled. Each supply chain has their own VaaS layer, or supply chains can also share one. Above this layer is the activation service where mobile apps are served to devices as App-as-a-Service (AaaS). The management policy of this layer differs per VaaS, or per supply chain within the same VaaS. The design considerations of these two service layers are discussed after the design objectives of VC are stated next.

The requirement of ‘anywhere anytime’ is fundamental to any e-services, or cloud-based e-services. Offering a visibility view of a supply chain is a phenomenon we call an instance phenomenon. That is, the value of a visibility view can only be defined with respect to that particular time instance. The phenomenon is characterized by on-demand, currency and soft real-time. In a supply chain context, that phenomenon is governed by the identity of the user, where the user is at the time of invocation, and the time marker for the request. While the Maker ensures that the data pool is rich, each datum is sensitive with respect to the role of the Wiser, and whose relationship with other parties in the supply chain. Three design objectives are defined for the VC, namely, 1) Identity-aware, 2) Temporal-Sensitive, and 3) Geospatial-aware. These objectives are considered in the design of the two layers in VC structure.

Service Stacks in Visibility Cloud
Figure 2 illustrates the two new services in a cloud computing model for the VC. The infrastructure and platform environment are also known based on the runtime parameters, such as computing power, storage requirement and memory size support.

A VP shell is packaged, e.g., a clean snapshot image, for activation on top of PaaS. Supply chain configuration specifications, e.g., business processes and hotspots, and others will be used to tailor the VP mechanism/software system for a particular supply chain. VaaS is a collection and creation facility. AaaS is the retrieval, activation, and delivery facility.

Visibility-as-a-service (VaaS)
VaaS facilitates participants in a supply chain to personally enable a visibility view by provisioning a VP with specific supply chain parameters. The composed SCV is immediately available for view and validated vApp deployment. The service will have these design considerations:

- A VP for provisioning with respect to a supply chain configuration
- A visibility view management for on-demand creation.
- A visibility data delivery mechanism to active vApps.

Supply chain configuration parameters include the following maps, 1) Business Processes Map, 2) Hotspot Activation Map, 3) IoT Data Schema and Flow Map, and 4) Relationship Map.

With the VP artifact in place in the VC, visibility views are defined as needed. Users of the VC, a community of supply chain staff, operational or managerial, begin their personalized visibility view construction, either as ad hoc or common visibility views to monitor and keep abreast of current statuses of supply chain. The identity of all users, along with their individual credentials and roles are properly incorporated into the VC. That is, a view when defined is associated with those who can use the service, with any location-specific restriction, and at the time of day when the service should be active.

This service alone enables visibility at points where a networked computing unit with a web browser exists and can be shared by many staff of the same unit. Our design extends to a mobile environment with access natively by networked smart devices.

App-as-a-service (AaaS)
Visibility views created at VaaS are instantiated as vApps and served on-demand from the Visibility Cloud functionally characterized by the user’s role (identity-aware), time of need (temporal-sensitive), and the location of the user (geospatial-aware).
AaaS brings SCV to the mobile environment with personalization and location-based security. Mobile apps that are offered by commercial entities such as banks and e-retailers are prominently promoted on their websites and physical stores. The app is free to download into anyone’s smart devices from two major ‘stores’ serving the iOS and Android mobile platforms. Personalization is often defined inherently with the smartphone’s profile information (e.g., phone number, or email login account), not the physical person that is using it.

Similar approach on the management of apps is suggested for enterprises with vApps. Employees of the enterprise have the right to access the AppVault (use of AppStore is avoided) once approved. A given vApp can be downloaded into the smart device of the employee once the credentials are validated. The vApp will be enabled by location based information (such as a designated GPS range, or by reading a NFC-location identification tag at site, or both), or identity information (such as facial recognition or fingerprint).

Design considerations for AaaS are:

- vApp manifestation – given a visibility view created via the VaaS, a quick transformation must be effected to a standalone application (vApp) for common mobile platforms.
- vApp configurability – each vApp is properly wrapped for identity, temporal and spatial control.
- vApp management – vApps for a given supply chain continues to grow, and retires as needed. Each vApp is downloaded from an AppVault where vApps reside.

Apps-as-a-service can take up different operating models clearly viewed from a service perspective. At this writing, the services are scoped within the community of a supply chain. In some configuration, a brand owner enables all managerial staff with AaaS according to the echelon of the supply chain the staff’s responsibility. Services could also be managed by a third-party entity similar to outsourcing the apps management.

**DISCUSSION**

Evaluation of the artifact with respect to the VP of ActiveWear has been carried out. The VP is deployed in a private cloud (OpenStack) for the Visibility Cloud of ActiveWear, using a snapshot of the VP created in storage. Via the cloud management console, the ActiveWear VP is provisioned as a VaaS based on the configuration maps that have been created for the supply chain. A ReplenishmentStatus vApp, in our case, is designed as an app (only the design has been done, not the actual implementation) for Android mobile devices based on a view created via the VP by a Wiser. Moreover, the material design by Google is used to design the vApp. The design of a vApp requires further investigation regarding privacy and security concerns, for activation control, and survivability.

A Visibility Cloud, by default, is fault tolerant and resilient. Current discussion is purely on one supply chain and one VC. Such notion is not necessary conducive in a supply chain network where collaborative efforts can be extended across supply chains. A community of VC’s of vertical supply chains can be designed with an integrative view of all business processes, effectively enabling data flow across supply chains with entitlement bridges.

Design principles of VC are manifested in VaaS with a basic policy specification, while the enforcement is carried out based on an entitlement specification at visibility delivery embedded within the vApp. Overrides could be designed to allow a one-time modification to the view for effective collaboration, but the policy change does not carry back with the vApp.

Based on the DSR Knowledge Contribution Framework, VC is an invention, as delivery of on-target on-demand SCV is a new problem. The solution is based on emerging technology development with a service view that SCV is a knowledge exchange of the Maker and the Wiser. The exchange is encapsulated in a descriptive view template, visualized in an App-as-a-Service deployment, and delivered on-demand as a service would and should, leveraging a powerful IT service paradigm, that the IT artifact Visibility Cloud is provisioned quickly with infrastructure and platform specifications.

**CONCLUDING REMARKS**

To remain competitive as a supply chain, its management practice, agile or lean or otherwise, must garner performance with achievable cost savings and wastage reduction. Supply chain visibility has been argued to be a valuable capability that could lead to better performance. Efforts in gaining such covert visibility often run into hurdles such as information sharing, data quality, IT investment, un-sustained ROI arguments, and the best visibility to have – the duality nature of visibility.

Visibility Cloud takes the concept of service into play, argues that purposeful data must be identified, created if they do not exist, shared when necessary, leverages big data such as IoT and social media, and such diverse on-target data pool enhances on-demand visibility, delivered by provisioning, and delivered to personal mobile devices. With VC, SCM is effective definite anywhere anytime.

This paper is a work-in-progress. Supply Chain Visibility can also be quantified as Supply Chain Analytics (SCA). That is, SCV is discussed as a view in this study, and it should not only be as such. Data gathered according to the visibility needs of a
user can be passed to an analytical engine to project further, e.g., with historical data and social trends and influences, a credible scenario of time in the near future. Models with prescriptive nature can also be used or developed accordingly.

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