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# Cost benefit factor analysis in e-services

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**Keywords** Worldwide web, Cost benefit analysis, Assessment

**Abstract** This paper first presents a research framework for e-service evaluation within four categories: cost, benefit, functions and development, each incorporating a number of factors. Through data analysis and hypotheses testing, inter-relationships among the factors of the four categories are examined. The results show that the development type of an e-service has a significant effect on the degree of user satisfaction. Expertise, technique and expense are the principle factors limiting current e-service adoption. The most significant finding is that, in the development of e-services, certain cost factors are significantly more important than others in relation to certain benefit factors. The finding is presented as a cost-benefit factor-relation model. This provides an insight into whether investment in certain areas of e-service applications is more important than in others for particular business objectives. These results have the potential to improve the strategic planning of companies by determining more effective investment areas and adopting more suitable development activities where e-services are concerned.

## 1. Introduction

The Internet is currently used as a platform through which services are delivered to businesses and their customers (Casati and Shan, 2001). Electronic services (e-services) have appeared on the Internet in the form of E-business sites and portal sites (Amor, 1999). Many companies are adopting Internet-based e-services for conducting business transactions and sharing business information with their customers and business partners (Torre and Moxon, 2001). More recently, companies have started using e-services as a means of automating relations with their customers and allowing customers to form alliances, by joining with company databases and information management systems.

The term “e-services” is typically used to describe a variety of electronic interactions, ranging from basic services, such as the delivery of news and stock quotes, to smart services, such as the delivery of context-aware emergency services (Chidambaram, 2001). E-service applications in Australia have shown rapid growth in the past few years, and have replaced many traditional ways of conducting business in the private and public sectors. There are many examples where individuals and businesses now transact with e-services, such as online learning services, online travel services, online delivery services, online tax return through etax, online application for an ABN (Australia business number) through the Business Entry Point, and online seeking employment opportunities through Jobsearch. According to results

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presented in NOIE (2000, 2001), about 50 per cent of Australian adults accessed the Internet and 37 per cent of Australian households connected to the Internet in 2000 and 2001. More than 13 per cent of adults have paid bills, or transferred funds, and 10 per cent have purchased, or ordered, goods or services via the Internet since 2000 (NOIE, 2001). Since 2000, 56 per cent of businesses have been connected to the Internet to making use of various online services. Australia Federal and local state governments are increasingly offering better online services at greater convenience to the public, and operating with greater transparency. They can be more responsive to the needs of clients, engage more closely with citizens, and be more efficient. For example, there are 1,600 services that have taken the first step towards an innovative use of the Internet to enhance government services (NOIE, 2002).

The ability of e-services to fulfil customer demands is assisting businesses in reducing service costs and obtaining more benefits. Service is an important measure of success in competitive markets and the Internet marketplace provides that service. As researchers have noted, e-business success is determined less by business models than by delivering topnotch, repeatable services that result in satisfied customers (Marshall, 2001). Companies in the earlier stages of employing e-services have had little data, knowledge and experience of the potential of e-services for organizational impacts and benefits. After several years experience of e-services, companies can obtain related knowledge and provide related data. They urgently need to weigh the costs involved in moving services online against the benefits received by adopting e-services. They must identify what kinds of investment effectively contribute to particular benefit aspects of an e-service application.

Recent reports concerning the success, quality, usability and benefit of e-services have led researchers to express increasing interest in conducting an evaluation of the use of e-service applications (Smith, 2001). In general, various research methods and techniques used in the research of E-service evaluation, such as surveys, cases and modelling, are instigated under three major categories. The first is Web site feature, function or usability evaluation, the second is investment analysis, and the third is establishment of evaluation frameworks or models.

For e-service Web site feature, function or usability evaluation, there are three traditional approaches: testing, inspection and inquiry (Hahn and Kauffman, 2002). The three approaches are often used together in conducting a web search or a desk survey. A Web search, or a desk survey, is often completed by external users or researchers. For example, Ng *et al.* (1998) has reported a desk survey of business Web sites and has discussed the features and benefits of Web-based applications. Zhang *et al.* (2001) conducted a survey to test the differences between Web design features in six Web site domains. Benbunan-Fich (2001) used a protocol analysis method to evaluate the usability of commercial Web sites. The latter study documented a way to evaluate the

usability of Web sites in terms of content, navigation and interactivity. More recently, Negash *et al.* (2002) presented research results for quality and effectiveness in Web-based customer support systems. This study indicated that information and system quality determine effectiveness, while service quality has no impact.

Research related to investment analysis has been conducted for justifying investment in an e-service application, and for exploring the changes that take place in organizational operations. For example, Giaglis *et al.* (1999) presented a case study of e-commerce investment evaluation. Furthermore, Drinjak *et al.* (2001) investigated the perceived business benefits of investing in e-service applications. While, Amir *et al.* (2000) created a cost-benefit framework for online management of a metacomputing system. The framework assumed that the cost of a resource is an exponential function of its utilization, and defined the benefit of completing a job as equal to its priority. Cost-benefit analysis (CBA), as a traditional method, has been used in various situations. However, CBA is not particularly suitable for assessing e-service applications. It is more suitable for cases where IT contributes solely to cost reduction. E-service is not such a case. Also, it is hard to establish comparable criteria in a cost-benefit analysis for an e-service application (Drinjak *et al.*, 2001).

Several evaluation frameworks and models have been proposed for making a synthetical evaluation for e-service applications. Lee *et al.* (1999) created a framework for evaluating the business value of B2B e-service through five propositions. Zhang and von Dran (2000) developed a two-factor model for Web site design and evaluation. Tang *et al.* (2001) proposed a conceptual model to demonstrate the rationale of buyer-supplier interaction with the information service provider's mediation in the e-commerce environment. Helander and Khalid (2000) used a system model to illustrate the relationships among three subsystems in e-commerce: store environment, customer and Web technology. More generally, Hahn *et al.* (2002) presented a value-driven framework for an e-commerce Web site evaluation.

Although existing literature provides an insight into e-service evaluation methods, frameworks and models, there are very few empirical studies having orientation from e-service provider perspectives, and no results for establishing a relationship between e-service cost and benefit factors. This study aims to identify the inter-relationships and interactive impacts among e-service functions, e-service development attributes, the benefits received via adopting an e-service, and the costs to move service operations online. In particular, this study examines which e-service functions and attributes are more important for obtaining higher benefits, and e-services' investment in which aspects have a more significant contribution to particular benefit items.

This paper first presents a research framework for e-service evaluation within four categories. It then identifies the main cost factors which are perceived as more important than other cost factors, and the main benefit

factors. It also examines what benefits have been obtained successfully and what costs are higher than estimated when developing an e-service application. The most significant results shown in the paper are that certain cost factors do significantly contribute to certain benefit factors, but may not for some other benefit factors in certain situations. This therefore provides an insight into whether investment in certain aspects of e-service applications is more important than in others. Based on these results, recommendations for developing and maintaining e-service applications are given. These will have the potential to improve the competitiveness, flexibility and strategic planning of companies by reducing e-service costs, increasing e-service benefits, and improving e-service activities. Building a better knowledge of the effect of cost on benefit can generate useful guidelines for developing successful e-services.

The remainder of the paper is organised into six sections. Section 2 describes a research framework of the study. Hypotheses design and data collection method are given in Section 3. Section 4 reports basic data analysis results regarding e-service functions and development attributes. Section 5 explores the inter-relationships between cost factors and benefit factors, and presents the results into a cost-benefit factor-relation model. Section 6 concludes the research findings. Limitations and further study are discussed in Section 7.

## 2. Research framework

Based on the previous works of Lu *et al.* (2001), Lu and Zhang (2002), Lu (2001), and a further broad range review of work, such as that of Drinjak *et al.* (2001), Greenemeier (2001) and Rehesaar (2001), four categories have been identified which compose a conceptual research framework for assessing e-service applications from a provider' perspective. The four categories are:

- (1) e-service function (F);
- (2) e-service cost (C);
- (3) e-service benefit (B); and
- (4) e-service development attribute (D).

E-service function is concerned with the capability and quality of the e-services. Cost is the expenses incurred in adopting e-services. E-service benefit is concerned with the benefits gained through employing e-services, which development attribute takes into account the strategies, policies and types of companies involved when developing e-service applications. Each category consists of a set of evaluation factors.

The number, type and function of e-services increase day by day. Eleven typical function factors are listed in an e-service function category including general information, e-mail requiring, delivery of customized information, advertising products and prices, online ordering/booking and online transactions. These functions also imply the levels of e-service complexity

(Lu *et al.*, 2001). For example, online payment is more complex than simply the advertising of products. Each e-service application may contain several, or all, of these functions.

Drinjak *et al.* (2001) have listed a number of benefit items within three categories of Web applications and their rankings. These items include: providing services 24 hours a day and seven days a week (24\*7); effective promotion of the company, together with the products and services it produces; enhancing the quality and speed of customer services; creating competitive advantages and subsequently avoiding competitive disadvantages; enticing shoppers and encouraging customer interaction; supporting core business functions which are integral to business strategy; providing new business opportunities, increasing market presence and facilitating online purchasing. The research also identified five items with relatively high rankings. Lu (2001) listed 21 benefit factors, and identified eight as the core benefit factors, through a survey conducted in New Zealand. They are:

- (1) accessing a greater customer base;
- (2) broadening market reach;
- (3) lowering of entry barrier to new markets and cost of acquiring new customers;
- (4) alternative communication channel to customers;
- (5) increasing services to customers;
- (6) enhancing perceived company image;
- (7) gaining competitive advantages; and
- (8) potential for increasing customer knowledge.

Based on the above research results, 16 e-service benefit factors are identified and are used in our study.

Lu (2001) also tested 19 cost factors and identified eight core cost factors:

- (1) expense of setting up applications;
- (2) maintaining applications;
- (3) Internet connection;
- (4) hardware/software;
- (5) security concerns;
- (6) legal issues;
- (7) training; and
- (8) rapid technology changes.

These eight cost items are used in the study as “cost factors”. Two concepts aggregate cost and aggregate benefit will be introduced in Section 5.

Liu and Arnett (2000) examined the factors associated with Web site success. Four factors affecting Web site success were identified:

- (1) information and service quality;
- (2) system use;
- (3) playfulness; and
- (4) system design quality.

Cost benefit  
factor analysis

575

Ranganathan and Ganapathy (2002) examined the key characteristics of a B2C Web site and found that security and privacy had a greater effect on the purchase intent of consumers. However, companies might have different criteria for evaluating e-service success, and different reasons and motives for developing e-service applications. They might also have different target customer groups, development strategies, and barriers (Terry and Standing, 2001). Some companies designed and implemented their e-service applications by themselves, while some were provided by external constructors. These attributes are explored in this study, in particularly, their effect on e-service benefits is analysed and discussed.

Figure 1 shows factors identified in each category: e-service function (E), cost (C), benefit (B) and development attributes (D), represented by a FCBD research framework.  $H_A, \dots, H_G$  imply a set of respective hypotheses.

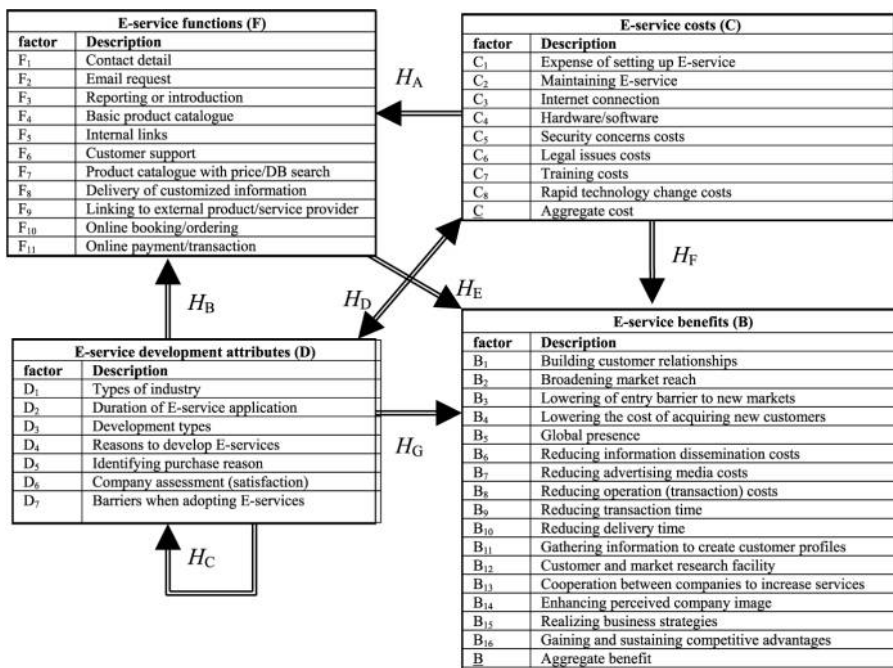


Figure 1.  
FCBD research  
framework with factors

### 3. Research methodology

#### 3.1. Hypothesis design

Hypotheses are designed based on the proposed FCBD research framework. As shown in Figure 1, seven groups of hypotheses were designed to address questions concerning the relationships among factors. For example,  $H_A$  contains a number of hypotheses ( $H_{A1}, H_{A2}, \dots, H_{Am}$ ) regarding the relationships between e-service functions and cost factors.  $H_B$  contains a number of hypotheses regarding the relationships between development attributes and functions.  $H_C$  contains a group of hypotheses regarding the relationships between development attributes.  $H_D$  contains a group of hypotheses regarding the relationships between development attributes and e-service cost factors.  $H_E$  contains a group of hypotheses regarding the relationships between e-service functions and benefit factors.  $H_F$  contains a group of hypotheses regarding the effects of cost factors on benefit factors.  $H_G$  contains a group of hypotheses regarding the effects of development attributes on benefit factors. Hypothesis testing, being the most common method used in inferential statistics, is completed in the study. A null hypothesis is used for each hypothesis testing, to determine whether the data are strong enough to reject it. That is, the null hypothesis either will or will not be rejected as a viable possibility. This study specifies the level of significance  $\alpha=0.05$ . This paper is restricted to presenting ten typical and interesting hypotheses proposed in the study and to discussing related test results.

#### *Hypothesis $H_{C1}$*

- $H_0$ . The three e-service development types ( $D_3$ ) are not significantly different in their effect on e-service success, as measured by the company assessment ( $D_6$ ). That is, they are equally effective in enhancing the company e-service performance.
- $H_{C1}$ . The e-service development type ( $D_3$ ) has an effect on e-service success, measured by the company assessment ( $D_6$ ). That is, the three development types are significantly different in effect on the company assessment.

#### *Hypothesis $H_{B1}$*

- $H_0$ . The number of functions (F) provided in e-services is not significantly different among industry sectors ( $D_1$ ).
- $H_{B1}$ . The number of functions (F) provided in e-services is significantly different among different industry sectors ( $D_1$ ). That is, the industry type has an effect on the number of e-service function provided.

#### *Hypothesis $H_{D1}$*

- $H_0$ . There is no significant difference on aggregate cost (C) among different industry sectors ( $D_1$ ).



$H_{D1}$ . There are significant differences on aggregate cost (C) among industry sectors ( $D_1$ ).

*Hypothesis  $H_{G1}$*

$H_0$ . There is no significant difference on aggregate benefit (B) among different industry sectors ( $D_1$ ).

$H_{G1}$ . There are significant differences on aggregate benefit (B) among industry sectors ( $D_1$ ).

*Hypothesis  $H_{F1}$*

$H_0$ . The cost factor "Expense of setting up e-service" ( $C_1$ ) has no effect on aggregate benefit (B).

$H_{F1}$ . The cost factor "Expense of setting up e-service" ( $C_1$ ) has an effect on aggregate benefit (B). That is, there is a significant difference in aggregate benefit between different groups of companies that have different levels in "Expense of setting up e-service".

*Hypothesis  $H_{F2}$*

$H_0$ . The cost factor "Maintaining e-service" ( $C_2$ ) has no effect on aggregate benefit (B).

$H_{F2}$ . The cost factor "Maintaining e-service" ( $C_2$ ) has an effect on aggregate benefit (B). That is, there is a significant difference in aggregate benefit between different groups of companies that have different levels in "Maintaining e-service".

*Hypothesis  $H_{F7}$*

$H_0$ . The cost factor "Training cost" ( $C_7$ ) has no effect on aggregate benefit (B).

$H_{F7}$ . The cost factor "Training cost" ( $C_7$ ) has an effect on aggregate benefit (B). That is, there is a significant difference in aggregate benefit for different groups of companies that have different levels in "Training cost".

$H_{Fx}$  ( $x=3, 4, 5$  and  $6$ ) have been designed in the same way as  $H_{F1}$ ,  $H_{F2}$  and  $H_{F7}$ .

*Hypothesis  $H_{F2-1}$*

$H_0$ . The cost factor "Maintaining e-service" ( $C_2$ ) has no effect on benefit "Building customer relations" ( $B_1$ ).

$H_{F2-1}$ . The cost factor "Maintaining e-service" ( $C_2$ ) has an effect on benefit "Building customer relations" ( $B_1$ ). That is, there is a significant difference in the benefit "Building customer relations" for different

groups of companies that have different levels in “Maintaining e-service”.

*Hypothesis  $H_{F2-2}$*

$H_0$ . The cost factor “Maintaining e-service” ( $C_2$ ) has no effect on benefit “Broadening market reach” ( $B_2$ ).

$H_{F2-2}$ . The cost factor “Maintaining e-service” ( $C_2$ ) has an effect on benefit “Broadening market reach” ( $B_2$ ). That is, there is a significant difference in the benefit “Broadening market reach” for different groups of companies that have different levels in “Maintaining e-service”.

*Hypothesis  $H_{F2-16}$*

$H_0$ . Cost factor “Maintaining e-service” ( $C_2$ ) has no effect on benefit “Gaining and sustaining competitive advantages” ( $B_{16}$ ).

$H_{F2-16}$ . Cost factor “Maintaining e-service” ( $C_2$ ) has an effect on benefit “Gaining and sustaining competitive advantages” ( $B_{16}$ ). There is a significant difference in the benefit “Gaining and sustaining competitive advantages” for different groups of companies that have different levels in “Maintaining e-service”.

$H_{F2-x}$  ( $x = 3, 4, \dots, 15$ ) have been designed in the same way as  $H_{F2-1}$ ,  $H_{F2-2}$  and  $H_{F2-16}$ .

*3.2 Data collection*

In order to test these hypotheses, a sample was selected and related data was collected. This study collected data concerning e-service development attributes, functions, costs and benefits from a sample of Australian companies (e-service providers). These sample companies were selected from two industry categories: tourism (including travel, accommodation, entertainment and health care) and IT/communication services (IT services and information services) in Australia. This study conducts data collection in three steps:

- *Step 1.* A Web search was first conducted to determine a sample of companies which have adopted e-services on an appropriate level and volunteers were obtained from these companies. A total of 100 Web sites were randomly selected from company Web sites registered in the Yellow Pages Online (NSW, Australia) [www.yellowpages.com.au](http://www.yellowpages.com.au) under Tourism/travel and IT/communication categories.
- *Step 2.* A company-oriented questionnaire survey was conducted with the sample companies from February to March 2002. As a pre-test survey, an initial questionnaire was sent to three subjects as a way of setting initial feedback. Based on the pre-test results, the questionnaire was refined. The

final questionnaire was then posted, e-mailed, or faxed, to the 100 selected companies. Out of 34 questions in the questionnaire, some items were related to e-service functions and development attributes, some were related to the costs of developing e-service applications, and some were related to the benefits obtained from developing e-service applications. The survey assumes that respondents represent their colleagues and they should not be asked directly about hypotheses. A total of 50 responses were obtained, and the results shown in this paper are based on 48 completed responses. All questions listed in the questionnaire use a five-point Likert scales, or gave a statement that required choosing or not choosing. The survey result was used to identify why companies adopt e-service applications, how they evaluate an e-service application, what the main benefit factors are, and what kinds of benefits have been obtained. It also identified the major costs and barriers of e-service applications and, most importantly, which cost items significantly contributed to particular benefit items.

- *Step 3.* A Web site function search for the 48 sampled companies was conducted by a research group. The data collected was used as objective empirical evidence to confirm the functions indicated by the companies in the above survey.

#### 4. Function and development attribute data analysis

##### 4.1 Descriptive statistical analysis

4.1.1 *Why do companies adopt e-service applications?* The survey result showed that the 48 companies sampled had employed Internet e-service for 3.1 years on average. These companies were distributed across six industry sectors. As shown in Table I, accommodation and IT service are two of the main sectors in the sample.

Companies may have different motives and reasons for developing an e-service application. As shown in Table II, about 50 per cent of the companies sampled indicate their reason for developing e-services is that “currently it is the way of doing business”, 27 per cent indicate that their competitors are adopting e-services, 41 per cent mention that their customers want

No.	Industry type	No. of companies	Per cent
1	Accommodation	12	25
2	Entertainment	5	10
3	Health care	3	6
4	Information service	8	17
5	IT service	15	31
6	Travel and others	5	10
	Total	48	

**Table I.**  
Classification of  
sampled companies

e-service-based business relations, and 73 per cent explain that adopting e-services is a part of their strategic plan. Some companies give other reasons for adopting e-services, such as: “another way to reach new customers”, “online knowledge management” and “e-service is a cost-effective solution”. One company explains that “we are an Internet technology company”.

*4.1.2 Are companies satisfied with their current e-services?* Each company was asked to give their assessment of current e-service development. The data in Table III shows about 27 per cent of companies think their e-service applications are “very successful”, 33 per cent “successful”, 29 per cent “moderately”, 8 per cent “very little benefit” and only one company records “not beneficial”. The results indicate that most companies are satisfied with their e-service development. Figure 2 further shows that there are different degrees of satisfaction among these industry sectors. Accommodation and information services sectors have, on average, relatively higher degrees of satisfaction.

The sampled companies can be divided into three groups based on their e-service development types. Out of the 48 companies, approximately 42 per cent of e-service applications were developed by in-house staff, 20 per cent by Web developers or contractors, and 38 per cent by both internal and external people (Table IV).

*4.1.3 What are the main barriers when adopting an e-service?* This survey explores the barriers encountered by companies when adopting an e-service application. About 33 per cent of the companies indicate that “lack of staff expertise” is one of the main barriers; 31 per cent indicate “difficulty in integrating Web with internal applications” is the main barrier. “Expense of setting up e-service” is recorded as one of main barriers by 40 per cent of the companies. “Expense of maintaining e-service”, “Lack of adequate training”

**Table II.**  
Motives and reasons for developing e-services

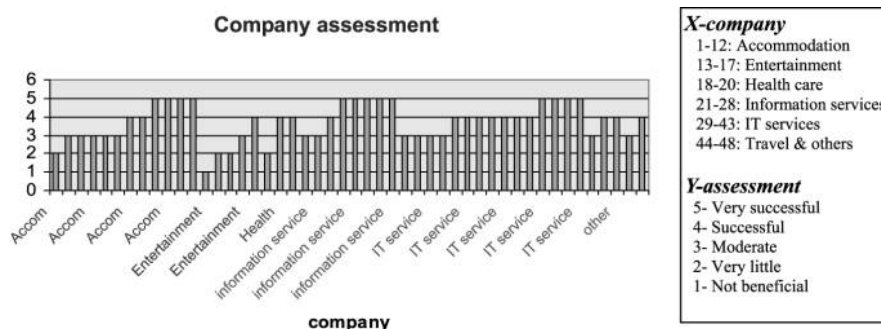
Why develop e-services ?	No. of companies	Per cent
Currently it is the way to do business	24	50
Our competitors are adopting e-services	13	27
Our customers want e-service based business relations	20	41
Adopting e-services is a part of their strategic plan	36	73
Others	10	21

**Table III.**  
Company assessment for their e-services

Company assessment for their e-services	No. of companies	Per cent
Very successful	13	27
Successful	16	33
Moderately	14	29
Very little benefit	4	8
Not beneficial	1	2
Total	48	

and “Lack of Web capable business partners” are recorded as barriers by 17 per cent, 13 per cent and 6 per cent, respectively. The results are shown in Table V. It was found that expertise, technique and expense are the three main barriers against e-service development.

However, different industry sectors may experience different barriers when adopting e-service applications. About 60 per cent of accommodation companies indicate “lack of staff expertise” as one of the main barriers; 42 per cent of accommodation, and all entertainment, companies indicate that “difficulty in integrating Web with internal applications” is a major barrier. Very few barriers are indicated by IT service companies. In particular, no IT service company indicates barriers in “expense of maintaining” or “adequate training”. Only one



**Figure 2.**  
Company assessment  
results distributed across  
different industries

E-service development type	No. of companies	Per cent
In-house staff	20	42
External Web developer or contractor	10	20
Both	18	38
Total	48	

**Table IV.**  
E-service development  
types

No.	Main barriers when adopting e-services	No. of companies	Per cent
1	Lack of staff expertise	16	33
2	Difficulty in integrating Web with internal applications	15	31
3	Expense of setting up Web-based e-services	19	40
4	Expense of maintaining Web-based e-services	8	17
5	Lack of adequate training	6	13
6	Lack of Web capable business partners	3	6
7	Resistance to structural changes within your company	6	13
8	Security problems associated with using Web based e-services	7	15

**Table V.**  
Barriers when adopting  
e-services

IT service company records “security problems” and one records “lack of Web capable partners” as a barrier. Thus, it is obvious, IT service companies find it easier to move their services online than other service companies.

By comparing the results of company assessment between groups which have different barriers, it was found that most companies that recorded their e-service applications as “very little benefit” or “not beneficial”, also marked “expense of setting up e-service applications” and “difficulty in integrating Web with internal applications” as the main barriers. This means that such companies must overcome barriers in setting up and integrating e-service applications before they can obtain ideal benefits.

*4.1.4 What functions are provided by e-service Web sites?* The data of 11 function factors is listed in Figure 1. The data was collected from the sampled e-service providers, and confirmed by a research group. The results (Table VI) show that over 90 per cent of sample Web sites provided contact details, reports, a basic product catalogue, and internal links. About 40 per cent of sample Web sites offered online booking, and 67 per cent produced a product catalogue, with price/DB search, available. However, only three companies (two in IT services and one in the accommodation sector) consistently sent information to customers, and only seven allowed online payment. Some companies provided almost all listed functions through their e-service Web sites, while some only provided a few. Out of the 48 companies, 14 companies provided eight or more of the functions listed.

*4.1.5 What features are important to customers in their decision to purchase through a Web site?* Liang and Huang (1998) found that transaction costs play a key role in consumer selection of electronic channels. Ranganathan and Ganapathy (2002) indicated security and privacy had a greater effect on the purchase intent of consumers. In this study, the subjects were asked to indicate one, or more, factors which have an effect on a customer’s decision to purchase at a Web site. The result, shown in Table VII, indicates 50 per cent of the companies think “guarantees transaction security” an important factor; 48 per

No.	Web site function	No. of companies	Per cent
1	Contact detail	43	90
2	E-mail request	39	81
3	Reporting or introduction	44	92
4	Basic product catalogue	43	90
5	Internal links	44	92
6	Customer support	21	44
7	Product catalogue with price/DB search	32	67
8	Delivery of customized information	3	6
9	Linking to external product/service provider	14	29
10	Online booking/ordering	19	40
11	Online payment/transaction	7	15

**Table VI.**  
E-service Web site  
functions

cent indicate “guarantees services or products offered” an important factor; 67 per cent indicate “provides useful information” is important, and 58 per cent express their concerns about “provides user-friendly navigation to information” and “provides fast service”. About 35 per cent of companies mention “provides lower cost than traditional methods”, and 33 per cent record “provides more options to customer services or more product selection” as one of the important factors. It was found that “providing useful information” was the most important factor, and the majority of listed factors were essentially equally important when attracting buying customers to a site.

4.2 Hypothesis  $H_C$  and  $H_B$  testing

This study first examines two groups of hypotheses,  $H_C$  and  $H_B$ , by using a one-way analysis of variables (ANOVA).  $H_C$  contains a group of hypotheses ( $H_{C1}, H_{C2}, \dots H_{Cp}$ ) involving relationships among development attributes.  $H_B$  group contains a number of hypotheses ( $H_{B1}, H_{B2}, \dots H_{Bn}$ ) involving relationships between development attributes and functions. Only the results of  $H_{B1}$  and  $H_{C1}$  are discussed in this paper.

To test  $H_{C1}$ , i.e. whether development type would have a significantly different effect on e-service application success as measured by company assessment, ANOVA is conducted, in order to examine the significance. Development type is used as the dependent variable, and company assessment as the independent variable. From the result shown in Table VIII,  $H_0$  of Hypothesis  $H_{C1}$  is rejected, since  $p$ -value (sig.) = 0.036 < 0.05 means that the test is strongly significant at 5 per cent. Based on the result, it would appear that the three development types do not have the same effect in determining company assessment. E-service applications which were both developed with type No. 3 earned a higher sample mean score obviously higher than type No. 1 and No. 2. Thus e-service applications developed by both internal staff and external developers are more likely to result in satisfaction and success. The alternative Hypothesis  $H_{C1}$  holds.

To test  $H_{B1}$ , the industry sector is used as the dependent variable, and e-service function distribution (the number of functions) as the independent

Which factors are important to customers in their decision to purchase at your Web site?	No. of com.	Per cent
Guarantees transaction security	24	50
Guarantees services or products offered	23	48
Provides useful information	32	67
Provides user-friendly navigation to information	28	58
Provides fast access services	28	58
Provides lower cost than traditional transaction methods	17	35
Provides more options to customer services or more product selection	16	33

**Table VII.**  
Factors effecting the purchase intent of customers

variable. The ANOVA result in Table IX shows that there is no significant difference of function distribution between different industries, as  $p = 0.205314 > 0.05$ . Hypothesis  $H_{B1}$  is rejected, and its null hypothesis is accepted. However, accommodation sectors provided the highest average number of functions – 7.25 as shown in Table IX.

**5. Cost-benefit factor-relation analysis**

*5.1 Main benefit factors and cost factors*

*5.1.1 What are the main benefit factors in adopting an e-service application?.* The questionnaire was designed to cover proposed benefit factors at an appropriate level, and of an appropriate form. The subjects were asked to indicate their present benefits assessment and ideal rating for each of the benefit factors. The current benefit assessment relates to the assessment of the status of each respondent’s e-service application, comparing it with where they would ideally like it to be. The ideal rating for benefit factors is tested on a five-point scale. Here “1” represents “not important at all”, and “5” “very important”. For example, if a

**Table VIII.**  
ANOVA (single factor)  
result for development  
type-company  
assessment

Groups	Count	Sum	Average	Variance		
Type No 1 (in house)	21	40	1.904762	0.790476		
Type No 2 (external)	9	19	2.111111	0.861111		
Type No 3 (both)	18	49	2.722222	1.153595		
ANOVA						
Source of variation	SS	df	MS	F	P-value	F crit
Between groups	6.690476	2	3.345238	3.557963	0.036766	3.20432
Within groups	42.30952	45	0.940212			
Total	49	47				
<b>Note:</b> * Significant difference ( $p < \alpha = 0.05$ )						

**Table IX.**  
ANOVA results for  
industry  
sectors-function  
distribution

Groups	Count	Sum	Average	Variance		
Accommodation	12	87	7.25	1.659		
Entertainment	5	28	5.6	2.8		
Health care	3	15	5	3		
Information services	8	54	6.75	2.214		
IT service	15	96	6.4	3.114		
Travel and others	5	29	5.8	4.7		
ANOVA						
Source of variation	SS	df	MS	F	P-value	F crit
Between groups	20.4625	5	4.0925	1.516409	0.205314	2.437694
Within groups	113.35	42	2.69881			
Total	133.8125	47				
<b>Note:</b> Significant difference ( $p < \alpha = 0.05$ )						



company considers that one of the most important benefits is enhancement of perceived company image, the company might score 5 on the ideal rating of the factor “enhancing perceived company image”. Table X shows the results of the ideal rating for benefit factors. It was found that B<sub>14</sub> (Enhancing perceived company image), B<sub>16</sub> (Gaining and sustaining competitive advantages), B<sub>1</sub> (Building customer relations), B<sub>2</sub> (Broadening market reach), B<sub>15</sub> (Realizing business strategies) and B<sub>4</sub> (Lowering the cost of acquiring new customers) received relatively higher rankings. This result means that the companies in our trial think these factors are more important than others for a successful business, and they have higher expectations of benefits in these areas.

*5.1.2 What benefits have been obtained through developing an e-service application?* Companies are all interested in maximizing the business value of e-services (Giaglis *et al.*, 1999). They have adopted business strategies which address the requirements of interoperability, quality of customer service, evolution and dependability. They expect to know which factors affect which aspects of e-service benefits and how e-service can increase these business benefits, by comparing related expenses with those of associated investments. In order to complete such an analysis, this study not only explores which benefit factors are more important to business but also seeks to find in which areas companies have obtained higher benefits, and alternatively which are lower. A five-point scale is also used for present benefit assessment: 1 = low benefit, 5 = very high benefit. For example, if a company considers that, currently, their e-service only builds very basic customer relations, and the company would ideally prefer to build close relations, then the company would score perhaps 3 on the present benefit assessment for B<sub>1</sub>. The assessment result, shown in Table XI, indicates that companies have obtained expected benefits on B<sub>14</sub> (Enhancing perceived company image), B<sub>16</sub> (Gaining and sustaining competitive advantages), B<sub>1</sub> (Build customer relationships) and B<sub>2</sub> (Broadening market reach) as these factors have a relatively high average score of current benefit assessment. In another words, companies are satisfied with these areas where benefits were obtained.

*5.1.3 What are the main cost factors involved when adopting an E-service application?* This works the same as for the benefit factor identification. The

Ideal rating	Number of companies in each benefit factor															
	B <sub>1</sub>	B <sub>2</sub>	B <sub>3</sub>	B <sub>4</sub>	B <sub>5</sub>	B <sub>6</sub>	B <sub>7</sub>	B <sub>8</sub>	B <sub>9</sub>	B <sub>10</sub>	B <sub>11</sub>	B <sub>12</sub>	B <sub>13</sub>	B <sub>14</sub>	B <sub>15</sub>	B <sub>16</sub>
1	0	0	3	1	5	5	3	5	5	5	4	2	4	1	1	1
2	2	4	6	2	7	3	4	3	2	4	5	4	5	2	3	2
3	8	9	9	9	12	6	9	9	6	9	4	11	6	3	8	5
4	10	12	15	16	5	16	15	13	14	6	16	12	11	9	10	8
5	27	21	12	18	17	16	15	15	19	19	15	15	18	30	23	29
NA	0	1	2	1	1	1	1	2	1	4	3	3	3	2	2	2
Average (w <sub>j</sub> )	4.3	4.1	3.6	4.0	3.5	3.8	3.8	3.6	3.9	3.7	3.8	3.8	3.8	4.4	4.1	4.4

**Table X.**  
Ideal rating for benefit  
factors

cost factors are ranked on a five-point scale: 1 = not important at all, 5 = very important. For example, if a company thinks the cost of maintaining an e-service is very important it records the degree of importance as 4 or 5. Table XII shows  $C_2$  (Maintaining e-services) as the most important factor, and  $C_5$  (Security concerns costs) as the second most important as they received relatively high average values (3.8, 3.7) of importance (weight). This finding shows that the companies have had, or would have, a higher investment in these important cost items.

*5.1.4 What cost items are higher than estimated when developing an E-service application?* This study also explores which items result in a higher cost than estimated, and which a lower cost. Here “1” represents very much lower than estimated cost, and “5” very much higher. The assessment result is shown in Table XIII. It was found that there was no cost factor with an average assessment value higher than 3.5. This means all costs were not much higher than estimated. However, some factors are still higher than others. For example, the average assessment values on  $C_1$  (expense of setting up e-service) and  $C_4$  (hardware/software) are relatively higher among the eight factors. Therefore, the differences between the actual cost and the estimated cost in the two areas were relatively bigger than other cost items within the companies.

**Table XI.**  
Current benefit assessment

Benefit assessment	Number of companies in each benefit factor															
	B <sub>1</sub>	B <sub>2</sub>	B <sub>3</sub>	B <sub>4</sub>	B <sub>5</sub>	B <sub>6</sub>	B <sub>7</sub>	B <sub>8</sub>	B <sub>9</sub>	B <sub>10</sub>	B <sub>11</sub>	B <sub>12</sub>	B <sub>13</sub>	B <sub>14</sub>	B <sub>15</sub>	B <sub>16</sub>
1	2	1	6	4	9	5	6	7	7	7	10	9	7	1	3	2
2	7	6	13	13	10	8	7	7	10	9	7	12	8	5	7	8
3	16	21	18	15	8	17	13	18	12	13	10	17	12	12	18	15
4	14	12	7	9	13	12	15	8	10	8	14	3	13	12	12	12
5	9	8	3	7	8	5	6	7	9	9	5	5	6	17	7	10
NA	0	0	1	0	0	1	1	1	0	2	2	2	2	1	1	1
Average ( $\bar{C}_i$ )	3.4	3.4	2.7	3.0	3.0	3.1	3.1	3.0	3.0	3.0	2.9	2.6	3.0	3.8	3.3	3.5

**Table XII.**  
Weights of cost factors

Cost weights	Number of companies in each cost factor							
	C <sub>1</sub>	C <sub>2</sub>	C <sub>3</sub>	C <sub>4</sub>	C <sub>5</sub>	C <sub>6</sub>	C <sub>7</sub>	C <sub>8</sub>
1	4	1	4	2	3	7	4	4
2	6	7	8	5	7	6	8	4
3	10	7	12	16	7	11	12	15
4	13	15	11	16	10	11	17	14
5	14	17	12	9	18	11	5	10
NA	0	0	0	0	2	2	2	01
Average ( $v_j$ )	3.6	3.8	3.4	3.5	3.7	3.3	3.2	3.4

Cost assessment	Number of companies in each cost factor								Cost benefit factor analysis
	C <sub>1</sub>	C <sub>2</sub>	C <sub>3</sub>	C <sub>4</sub>	C <sub>5</sub>	C <sub>6</sub>	C <sub>7</sub>	C <sub>8</sub>	
1	7	6	15	6	7	9	9	8	<b>587</b>
2	5	10	10	7	9	11	9	7	
3	10	12	15	15	11	14	17	9	
4	17	17	7	13	12	8	9	19	
5	9	3	1	7	7	4	2	3	
NA	0	0	0	0	2	2	2	2	
Average( $\bar{B}_i$ )	3.3	3.0	2.4	3.2	3.1	2.7	2.7	3.0	

**Table XIII.**  
Current cost assessment

### 5.2 Aggregate cost and aggregate benefit

*Definition 1.* For each company, aggregate cost  $\underline{C}$  is defined by:

$$\underline{C} = \left( \sum_{j=1}^k v_j \bullet C_j \right) / k, (k \leq 8),$$

where  $\{C_1, C_2, \dots, C_8\}$  is a cost factor set,  $C_i$  ( $i = 1, 2, \dots, 8$ ) can have value 1, 2, 3, 4 or 5,  $v_1, v_2, \dots, v_8$  (shown in Table XII) are the average weights (degree of importance) of the cost factors,  $k$  is the number of valid cost factors for the company.

*Definition 2.* For each company, aggregate benefit  $\underline{B}$  is defined by:

$$\underline{B} = \left( \sum_{j=1}^k w_j \bullet B_j \right) / k, (k \leq 16),$$

where  $\{B_1, B_2, \dots, B_{16}\}$  is a benefit factor set,  $B_j$  ( $j = 1, 2, \dots, 16$ ) can have value 1, 2, 3, 4 or 5,  $w_1, w_2, \dots, w_{16}$  (shown in Table X) are the average weights (degree of importance) of the benefit factors,  $k$  is the number of valid benefit factors for the company.

The purpose of introducing the concepts of aggregate cost and aggregate benefit is to find a measure to assess the actual e-service cost and the benefit obtained among the sampled companies. The two concepts use a weighted average method, that takes into account the proportional relevance of each cost or benefit factor, rather than treating each component equally. They, therefore, represent respectively, the expected return on the aggregation of a company's e-service costs and benefits. Each cost factor, such as setting e-services, maintaining e-services and training staff, is weighted in the calculation according to its prominence in the e-service investment, and each factor of benefit is weighted in the calculation according to its prominence in the e-service benefit. By analysing the distribution of aggregate cost and aggregate benefit in the 48 sampled companies, it was found that the investment assessment, measured by aggregate cost, and the benefit assessment, measured

by aggregate benefit, were not well-distributed. The aggregate costs or aggregate benefits are obviously higher for some companies than for others.

5.3 Correlation analysis between aggregate cost and aggregate benefit

To describe the relationship between aggregate cost and aggregate benefit, Figure 3 is presented. It shows the curves of aggregate cost (the lower curve) and aggregate benefit (the upper curve). It is found from Figure 3 that, in general, as aggregate cost value increases (or decreases) the aggregate benefit value increases as well, although sensitive degrees of change vary among the sampled companies. A correlation coefficient,  $r$ , is used to determine the relationship between the two variables. The correlation analysis result shows that the  $r$ -value of the aggregate cost and aggregate benefit is 0.48. The result indicates that the aggregate cost and aggregate benefit are not very well correlated. One of the main reasons is the actual costs of some companies were much higher than estimated, while the benefits were much less than expected. These situations are reflected in Figure 3, where there is a short distance between the two curves of those companies. These companies were distributed across several industry sectors. By analyzing the results using company assessment data, it was found that most of the companies recorded their e-service applications as “very little benefit” or “moderate”.

In order to identify relationships between the aggregate benefit (aggregate cost) of companies and their assessment for e-service success, the sampled companies were divided into four groups based on their assessment results as shown in Table III. Computation of the aggregate cost and aggregate benefit in each group were undertaken, and the results shown in Table XIV. It was found that the aggregate benefit value increases, while the aggregate cost decreases, in general, when group number is changed from No. 1 to No. 4. The results indicate that the companies which recorded “successful” or “very successful” for their e-services have obtained expected benefits and their expenses associated with e-services were not more than estimated costs. On the other hand, the companies which marked “very little” or “not of benefit” for their e-services have not obtained the expected benefit or have over-estimated cost, or both.

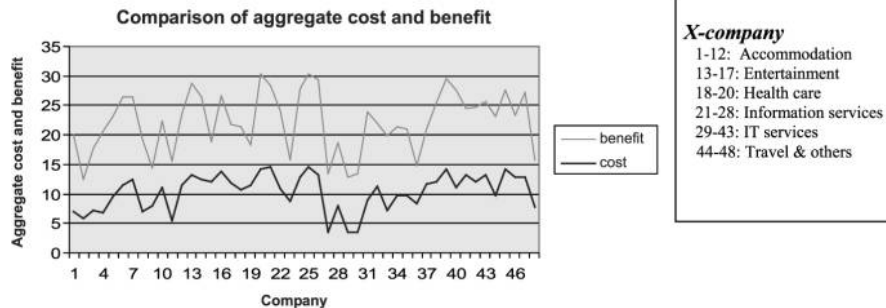


Figure 3. Comparison of aggregate cost and benefit in 48 sampled companies

The relationships between the number of functions and aggregate benefit (aggregate cost) are tested using correlation analysis. The results show that both aggregate cost and aggregate benefit are not relative to the number of functions. One of possible reasons is the number of functions is not a unique measure to assess e-service function.

Cost benefit  
factor analysis

589

#### 5.4 Aggregate cost and benefit among industry sectors (Hypotheses $H_D$ and $H_G$ testing)

As mentioned in Section 3.1, only  $H_{D1}$  and  $H_{G1}$  of the hypotheses  $H_D$  and  $H_G$  groups are discussed in this paper. In order to explore  $H_{D1}$ , i.e. whether the aggregate cost in the various industry sectors would have significant difference, an ANOVA was conducted to examine the significance of each of the specified industry sectors. The industry sector is used as the dependent variable, and the aggregate cost as the independent variable. As shown in Table XV, the  $p$ -value = 0.108249 > 0.05, the aggregate costs are not significantly different among the six industry sectors. This result rejects  $H_{D1}$ , and its null hypothesis is accepted. However, it was found that entertainment companies (13-17) had a higher aggregate cost on average than other sectors.

An ANOVA was conducted to examine the impact of each of the specified industry sectors on the aggregate benefit ( $H_{G1}$ ). As shown in Table XVI, the  $p$ -value = 0.984417 > 0.05, and thus the aggregate benefits are not significantly different among the six industry sectors. The result rejects  $H_{G1}$ ,

Group no.	Company assessment	Average aggregate cost	Average aggregate benefit
Group 1	Very successful	10.17	13.42
Group 2	Successful	10.11	12.34
Group 3	Moderate	10.32	10.69
Group 4	Very little or not of benefit	11.73	9.68

**Table XIV.**  
Aggregate cost and  
benefit in different  
groups

Groups	Count	Sum	Average	Variance		
No. 1: Accommodation	12	103.14	8.595	6.129173		
No. 2: Entertainment	5	63.38	12.676	0.67643		
No. 3: Health care	3	36.33	12.11	3.2977		
No. 4: Information services	8	86.86	10.8575	14.90296		
No. 5: IT services	15	149.79	9.986	10.58445		
No. 6: Travel and others	5	57.56	11.512	6.97412		
ANOVA						
Source of variation	SS	df	MS	$F$	$p$ -value	$F$ crit
Between groups	84.10218	5	16.82044	1.978201	0.101746	2.437694
Within groups	357.1216	42	8.502895			
Total	441.2238	47				

**Table XV.**  
ANOVA (single factor)  
results by industry  
sectors-aggregate cost

**Note:** \* Significant difference ( $p < \alpha = 0.05$ )

**Table XVI.**  
ANOVA (single factor)  
results of industry  
sectors-aggregate  
benefit

Groups	Count	Sum	Average	Variance		
No. 1: Accommodation	12	138.9	11.575	7.5087		
No. 2: Entertainment	5	59.18	11.836	12.32998		
No. 3: Health care	3	33.69	11.23	22.8193		
No. 4: Information services	8	100.96	12.62	10.35889		
No. 5: IT services	15	177.83	11.855	7.19907		
No. 6: Travel and others	5	59.37	11.874	7.03378		
ANOVA						
Source of variation	SS	df	MS	F	P-value	F crit
Between groups	6.781585	5	1.356317	0.150309	0.97884	2.437694
Within groups	378.9885	42	9.023536			
Total	385.7701	47				
<b>Note:</b> * Significant difference ( $p < \alpha = 0.05$ )						

and its null hypothesis holds. It is shown clearly in Table XV that the average values of the six groups were very close – from 11.23 to 12.836. This is understandable, because every specified industry sector may have successful and unsuccessful cases.

*5.5 What cost factors have a significant effect on benefit factors (Hypothesis  $H_F$  testing)?*

Given that the cost has a significant effect on the benefit of e-service applications, this study identifies which cost factor(s) had a significant effect on e-service benefit, measured by the aggregate benefit. As discussed above, the study classifies each cost factor into five clusters based on current cost assessment results. A number of ANOVA tests are conducted to examine the significance of aggregate benefits for each cost factor. Cost factors were used as dependent variables, and the aggregate benefit as an independent variable. As shown in Table XVII, the aggregate benefit is significantly different among the five assessment values of the cost factors  $C_2$ ,  $C_5$ ,  $C_7$  and  $C_8$  ( $p < 0.05$ ), which supports Hypotheses  $H_{F2}$ ,  $H_{F5}$ ,  $H_{F7}$ , and  $H_{F8}$ , and rejects other Hypotheses  $H_{Fj}$

**Table XVII.**  
ANOVA results for cost  
factors-aggregate  
benefit

Hypothesis no.	Cost factors	Average values					ANOVA P
		= 1 very low	= 2	= 3	= 4	= 5 very high	
$H_{F1}$	$C_1$	10.38	10.1	12.17	12.42	13	0.189147
$H_{F2}$	$C_2$	9.8	10.2	12.5	12.8	14.2	0.018672*
$H_{F3}$	$C_3$	10.94	10.85	13.3	12.24	12.3	0.149326
$H_{F4}$	$C_4$	11.38	10.86	12.77	12.61	10.04	0.181154
$H_{F5}$	$C_5$	9.6	12	12.5	13.4	13.8	0.004585*
$H_{F6}$	$C_6$	10.32	11.05	12.34	13.89	12.78	0.06979
$H_{F7}$	$C_7$	10.55	10.81	12.66	12.77	12.77	0.037262*
$H_{F8}$	$C_8$	9.39	11.6	11.62	12.58	15.73	0.008651*
<b>Note:</b> * Significant difference ( $p < \alpha = 0.05$ )							

( $j = 1, 3, 4, 6$ ). The result indicates that increasing investment in cost factors  $C_2, C_5, C_7$  and  $C_8$  will effectively improve the e-service aggregate benefit than other cost factors. In particular, it was found that there is enough differences between the aggregate benefits on the five levels of  $C_2$  (Maintaining e-service) and  $C_5$  (Security). Thus any increase of investment into the maintenance of e-services and security would significantly improve the e-service aggregate benefit whatever the company is and at any stage of the e-service implementation.  $C_7$  does not have the same property, as the average values of aggregate benefit are the same between group 4 (cost assessment = 4) and group 5 (cost assessment = 5).

To explore whether the cost factors at different levels would have different effects on individual benefit factors, 128 ANOVA tests were conducted. That is, we let any cost factor  $C_i$  ( $i = 1, 2, \dots, 8$ ) be dependent variables with five levels, and benefit factors  $B_j$  ( $j = 1, 2, \dots, 16$ ) be independent variables, and an ANOVA is completed to test whether the values of the benefit factor have a significant difference according to the cost factor at the five levels. Table XVIII simply shows the ANOVA results of  $C_2$  (Maintaining e-service) on the 16 benefit factors. The results indicate that cost factor  $C_2$  has a significant effect on  $B_1, B_2, B_7, B_{13}$  and  $B_{14}$  ( $p < 0.05$ ). That is, increasing investment on e-service maintenance will significantly contribute to “building customer relations”, “broadening market reach”, “reducing advertising media costs”, “establishing cooperation between companies to increase services”, “enhancing perceived company image”, and “gaining and sustaining competitive advantages”. The

Hypothesis no.	Cost factors	Benefit factors	= 1 very low	Average values				ANOVA	
				= 2	= 3	= 4	= 5 very high	<i>F</i>	<i>P</i>
$H_{F2-1}$	$C_2$	$B_1$	2.8	2.8	3.7	3.8	4	2.616	0.0485*
$H_{F2-2}$	$C_2$	$B_2$	2.6	3	3.5	3.7	4.3	2.7	0.0423*
$H_{F2-3}$	$C_2$	$B_3$	2.3	2.6	2.7	2.9	3	0.4398	0.77
$H_{F2-4}$	$C_2$	$B_4$	2.8	2.4	3.4	3.3	3	1.2178	0.31
$H_{F2-5}$	$C_2$	$B_5$	2.2	2.6	3.3	3.2	3.3	1.033	0.401
$H_{F2-6}$	$C_2$	$B_6$	2.8	2.7	3	3.1	4.3	1.265	0.298
$H_{F2-7}$	$C_2$	$B_7$	2.5	2.9	3.6	3.6	4.7	3.5	0.0147*
$H_{F2-8}$	$C_2$	$B_8$	2.6	2.4	3.3	3.1	3.67	1.24	0.309
$H_{F2-9}$	$C_2$	$B_9$	2.6	2.3	3	3.4	4	1.8	1.45
$H_{F2-10}$	$C_2$	$B_{10}$	2.5	2.7	3.4	2.9	4	1.152	0.34
$H_{F2-11}$	$C_2$	$B_{11}$	2.8	2.6	2.8	3	3.7	0.446	0.77
$H_{F2-12}$	$C_2$	$B_{12}$	2.1	2.1	2.7	2.9	3.3	1.27	0.29
$H_{F2-13}$	$C_2$	$B_{13}$	2.2	2.7	3.1	3.3	4.7	2.65	0.046*
$H_{F2-14}$	$C_2$	$B_{14}$	2.5	3.6	4	4.3	4.7	3.88	0.009*
$H_{F2-15}$	$C_2$	$B_{15}$	2.5	3.2	3.5	3.4	3.3	0.939	0.45
$H_{F2-16}$	$C_2$	$B_{16}$	2.3	3	3.6	4.1	3.7	3.62	0.0013*

Note: \* Significant difference ( $p < \alpha = 0.05$ )

**Table XVIII.**  
ANOVA results involving cost factor “Maintaining e-service”-benefit factors

result supports Hypotheses  $H_{F2-1}$ ,  $H_{F2-2}$ ,  $H_{F2-7}$ ,  $H_{F2-13}$ ,  $H_{F2-14}$ , and  $H_{F2-16}$ , but rejects others in the group of hypotheses.

5.6 Cost-benefit factor-relation model

By completing the 128 ANOVA tests, a set of “effect” relationships between cost and benefit factors are obtained. These relationships reflect that certain cost factors have a significant effect on certain benefit factors. These effects are presented in a cost-benefit factor-relation model (Figure 4). The lines in the model express the “effect” relationships between related cost factors and benefit factors. Although every cost factor makes direct or indirect contributions to all benefit factors to a certain degree, some cost factors are more important for the improvement of particular benefit factors than others. The model can help e-service providers effectively identify important investment items based on their business objectives when developing e-services. For example, if a company would like to improve their customer relationships ( $B_1$ ), the model tells us that to increase investment on maintaining e-services ( $C_2$ ), security concerns ( $C_5$ ) and training ( $C_7$ ) will be effective. The model can also help e-service providers analyse the possible benefit aspects of an investment. For example, investment on staff training ( $C_7$ ) will significantly contribute to “building customer relations” ( $B_1$ ), “reducing advertising media costs” ( $B_{10}$ ), and “gaining and sustaining competitive advantages” ( $B_{16}$ ).

6. Conclusions

Our research results show that companies have different motives for developing their e-service applications and different degrees of satisfaction for their e-service applications they develop. Development type had a significant effect on degree of

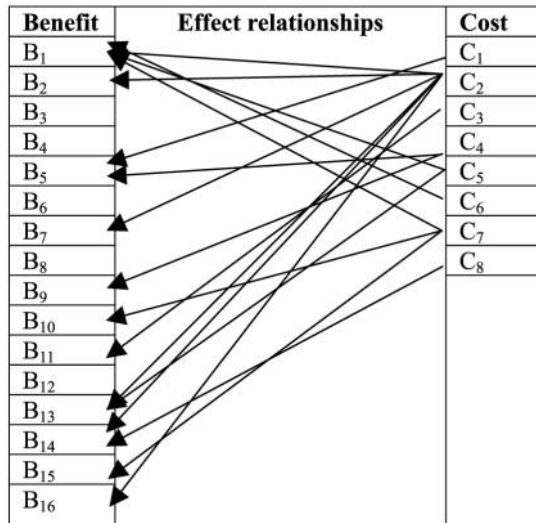


Figure 4.  
Cost-benefit  
factor-relation model



satisfaction. E-service applications developed by both internal staff and external developers were more likely to result in satisfaction and success. This study also shows that lack of expertise and technique, together with expense, were the main barriers confronting e-service development. Although basic e-service functions were provided at most e-service Web sites, customer-oriented functions, such as delivery of customized information, needed to be improved. The study found that accommodation companies provided more e-service functions than did in other industry sectors. "Providing useful information" was the most important factor, and had a greater effect on the purchase intent of customers.

By accessing "ideal rating" and "current situation" of benefit factors, this paper identified the main benefit factors which had higher expectations of benefits than others, and the success benefit factors which obtained successfully higher benefits than expected. The benefit factors with a higher expectation of benefit would appear to be more important than other benefit factors to business objectives. The study also identified the main cost factors which were perceived as more important than other cost factors, and high cost factors whose values were higher than estimated. Aggregate cost and aggregate benefit were introduced, and their distributions within the 48 sampled companies were presented. In general, it would appear that, as the aggregate cost value of a company's e-service increases, its aggregate benefit value increases, although there are different subtle degrees between companies. As shown in the paper, the companies which recorded "successful" or "very successful" for their e-services were basically satisfied with the benefit obtained, and the cost involved through developing an e-service. A number of ANOVA results indicate that some cost factors are of more importance in improving e-service benefits, than others. For example, a higher investment in maintaining e-services would improve significantly the aggregate benefit of e-services. Another interesting result reported in the paper is that certain cost factors were significantly more important than others to certain benefit factors. For example, increased investment in maintaining e-services would significantly contribute to "building customer relations" and "enhancing perceived company image". In order to improve the perceived company image it would be appropriate to invest in "maintaining e-services" and "rapid technology changes". The result provides an insight into whether investment on certain e-service aspects are perceived as more important than others for specific business objectives.

The findings shown in the study will provide practical recommendations to the following:

- e-service providers, when forming strategies to reduce e-service costs, increase benefits, enhance e-service functionality and attract customers;
- e-service application developers, when designing new applications;
- e-service managers, for maintaining current e-service applications which provide better services and more effective operations; and

- independent evaluators, who determine evaluation factors for e-service applications.

## 7. Limitations and further research

The main limitation of this study is its small sample company size. Another limitation is that the results were generalized over businesses in six specified industry sectors.

Future research will conduct a sensitivity analysis of cost and benefit factors, and apply a structural equation modelling approach (Byrne, 1998) to further explore relationships among multiple cost factors and benefit factors. We have already conducted a customer-oriented survey to evaluate such sampled e-service applications. The data collected from customers will be used, together with the data collected through the company-oriented survey, in order to test relationships between customer satisfaction and business cost/benefit factors. For example, to explore whether or not maintaining e-services has a significant effect on customer satisfaction.

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