Developing a B2B E-Commerce Evolution Model -- The Case Studies of Seven Industries in Taiwan

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ABSTRACT

The e-commerce environment is changing fast and getting mature, the internet technology enabled evolution created many new business organizations and new business models. It also caused new competitions and new management challenges. Although B2B e-marketplace have been promoted as tools for reducing transaction costs, streamlining process efficiency, and enabling virtual collaboration among partners, there are still not many successful B2B e-marketplaces in Asian. This research tried to develop an evolution model based on the IOS (Inter-Organizational Systems) model defined by Benjamin (1990)(1)and Applegate et al, (1996)(2). Through over 100 firms' case studies in seven industries of Taiwan, the patents of business partnership structures and the path of e-marketplace evolution were found. In order to explore the factors effected e-marketplace evolution, this paper summarized the possible impact factors based on 'Transaction cost theory', 'Resource dependent theory', 'Institution theory', and the 'Contextual Influences' which were highlighted as three levels in previous study – socio-cultural, national/regional, and structural (Hsiao and Ming, 2002)(3). The questionnaires were developed and mailed to 980 firms on the list of class-A members of 'Taiwan Taiwan Electric and Electronic Manufacturers' Association.' 178 valid questionnaires were received and investigated. The data analysis result suggested that factors of institutionalization effect may be one of the most significant impact dimensions of e-marketplace evolution.

Keywords: Inter-Organizational System, e-marketplace, Industry Value Chain

1. INTRODUCTION

The e-commerce environment is changing fast and getting mature, the internet technology enabled evolution created many new business organizations and new business models. Beside a mass of merit and chance, internet also created new competitions and new management challenges. The enterprises could connect to supplier, business partners and customers through internet. This could not only increase the efficiency and reduce the cost of business transactions but also create the changes to the value chain of enterprise and the supply chain crossed different organizations. There has been a rising interest in using e-marketplaces (electronic marketplaces) to enable closer B2B (Business-to-Business) collaboration (Hsiao and Ming, 2002)(3? . Many IT solution providers and government agents put lots of effort and investment to encourage firms to implement e-business especially the B2B e-marketplace. But market analysts have reported that the majority of the e-marketplaces have either closed down or are facing difficulties in attracting buyers and suppliers (Markus and Soh, 2002)(4? . The study is an initial attempt to building a three dimension evolution model to investigate the evolution path of the B2B e-commerce development progress and the reasons for the success or failure.

2. THE IOS REVOLUTION

The popularity of IOS (Inter-Organizational Systems) started in the late 1960s. Felix Kaufman (1966)(5) first described the "information partnerships" through the information systems cross the Organizational Boundaries. Barrett and Konsynski (1982)(6) highlighted the value of IOS is to share information cross the organizations. Cash and Konsynski (1985) (7)defined IOS as: 'the automatic information systems shared by more than two companies.' They stressed that IOS can improve the productivity, flexibility and competition advantages. Malone, et al., (1987)(8) classified the IOS as electronic hierarchy and electronic market. The electronic hierarchy is for the control, communication and coordination between the different hierarchical levels of organizations. The electronic market is to support the market functions between different organizations. Bakos (1991)(9)based on the function classified the IOS as 'Information Links' and 'Electronic Market.' The information links are the 'Communication Channels' between the organizations in the industry value chain. The electronic market is the 'Intermediaries' or 'Marketplace' for buyer and seller.

Benjamin (1990)(1)divided the IOS into the two dimension matrix as figure 1. Benjamin claimed that the IOS implementation of the organization is an evolution process, the type of IOS will be changed from time to

time as the business changed. Konsynski (1993)(10) based on the 'Interaction Patterns' to divide the IOS into one-to-one, one-to-many, and many-to-many. Applegate, McFarlan and McKenney (1996) in their book--Corporate Information Systems, created a two dimension model to describe the IOS evolution path from single sales channel to electronic marketplace. Figure 2 list these two dimensions as 'Interaction Patterns' and 'Levels of Control.'

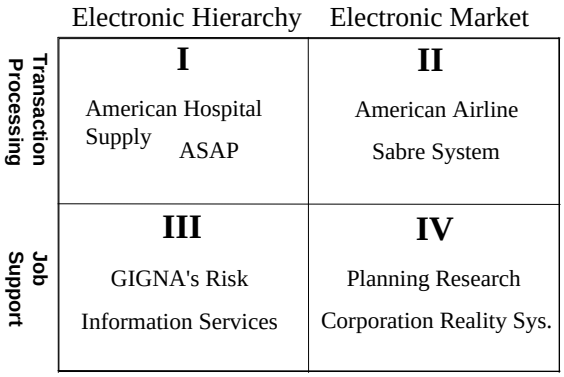

Figure 1. IOS evolution (adopted from Benjamin, 1990)

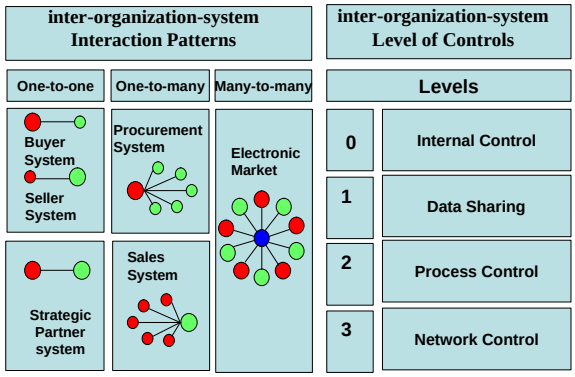

Figure 2. IOS Interaction Patterns and Level of Controls (Adopted from Applegate et al, 1996)

3. DEVELOPING A B2B E-COMMERCE EVOLUTION MODEL

This paper try to develop an evolution model by integrated the frame work created by Benjamin and Applegate et al., (Figure 3). The cases of America Airline (AA) and America Hospital Supplier Company (AHSC) were marked in the model to illustrate the path of 'evolution.' Both the AA and AHSC cases showed the IOS evolution started from Data sharing/Transaction processing to Network Control/Collaboration in the Control Level, and from one-to-one/electronic hierarchy to many-to-many/ e-marketplace.

This evolution model were tested and confirmed by over 100 cases study in seven different industries including grocery (30 companies), costume and accessories (8 companies), electronic (20 companies), books (14 companies), pharmaceuticals and cosmetics(12 companies), logistics(10 companies) and tourist(7 companies) industries. With the support from the Information Service Industry Association of Taiwan, a team of researchers and practitioners investigated the comprehensive files of over 100 firms that implement their B2B/IOS with their business partners during the period of three years from 2002 to 2004. The results confirmed the development of IOS in different industry do follow the similar path as AA and AHSC. The cases of Electronic, Books and Grocery are presented in Figure 4.

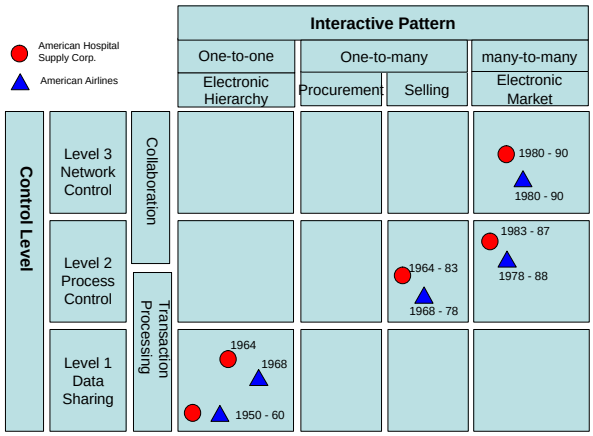

Figure 3. IOS evolution progress (the cases of America Airline and AHSC)

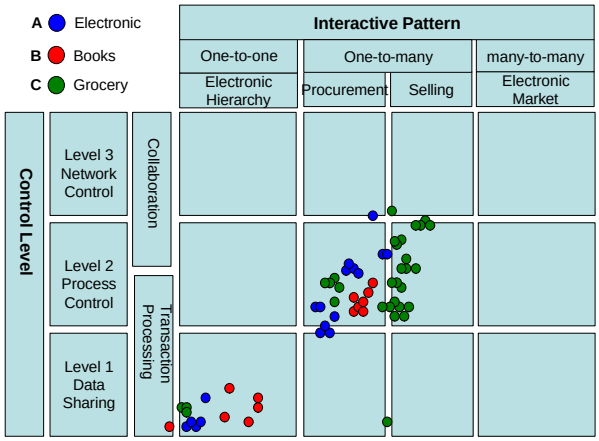

Figure 4. IOS evolution progress (the samples of three industries in Taiwan

Although the progresses of IOS/B2B system development are different between different companies, there seems to be some similarities in the same industry. The overall maturity of e-business development in electronic industry and grocery industry are better than the books in average. In order to understand the reasons of these similarities, the researchers need to further explore the business partnership structures and the readiness of B2B e-commerce in different industries. According to the documents provided by the Information Service Industry Association of Taiwan, the researchers can investigate the important connections

between B2B e-commerce development and industry value chains. Over 100 copies of business plan and system implementation documents were reviewed and categorized. Five patents of business partnership structures and the path of e-marketplace evolution were found. Those five business partnership patterns— which were named as central competition, cross competition, intermediary dependant, crisscross and proprietary (figure 5); reflect the power structures in the supply chain of different industries. How are these different power structures effect the B2B e-commerce development in different industries? Lots of academic research mentioned many factors that might impact the success of B2B e-commerce. Could we find out the connections between those influence factors and the B2B e-commerce evolution?

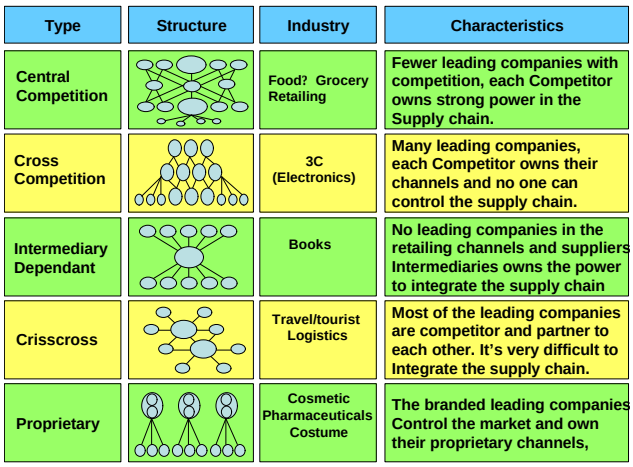

Figure 5. Patten of Industry Business Partnership

4. EFFECT FACTORS OF THE EVOLUTION

In order to explore the factors effected e-marketplace evolution, this paper summarized the possible impact factors based on 'Transaction cost theory', 'Resource dependent theory', 'Institution theory', and the 'Contextual Influences' which were highlighted as three levels in previous study – socio-cultural, national/regional, and structural (Hsiao and Ming, 2002) (3).

All the factors and their related articles and the theory based are listed in table 1.

Table 1 Factors that Effect IOS/B2B e-commerce

Theory	Reference
Transaction Cost Theory	
Transaction cost	Dietrich (1994) (11) Mahoney (1992) (12)
Uncertainty	Robertson and Gatignon (1998) (13)
Dependence	Barney(1990) (14) Williamson(1988) (15)Anderson and Narus (1990) (16) Zaheer and Venkatraman (1994) (17)
Resource Dependent Theory	
Dependent	Emerson(1962) (18)Pferffer&Salancik(1978) (19)
Asset Specificity	Sengupta, Krapfel and Pusateri (1997) (20)Zaheer andVenkatraman (1994)(17)
Institution Theory	
Coercive	DiMaggio&Powell(1983) (21) Forgarty(1992) (22)
Mimetic	DiMaggio&Powell(1983) (21)Forgarty(1992)(22)? Galashiewicz (1985)(23)
Normative	DiMaggio &Powell(1983) (21) Lachman & Aranya (1986) (24)
Contextual Influences	
National/Regional	Avgerou (2001) (25) Hsiao and Ming（2002） (3)
Socio-cultural	Kumar(1998) (26) Hsiao and Ming（2002） (3)
Structural	Markus & Soh(2002) (4) Hsiao and Ming（2002） (3)

5. DATA COLLECTION AND ANALYSIS

Based on the literature review and the summarized factors listed in table1, the questionnaires were developed to find out the possible factors effect the B2B e-commerce development in Taiwan. Due to the cost and time constrains, the survey is just for the electronic industry in the first stage. Data were collected from the list of class-A members of 'Taiwan Taiwan Electric and Electronic Manufacturers' Association.' and mailed to 980 firms between February 2004 and April 2004. There are 178 valid questionnaires were received and investigated.

Simple bi-variable associations among the collected variables reported as Spearman rank-order correlation coefficients. Factor analysis was used to describe the interrelationships of multiple variables. This kind of analysis is a multivariable analytic technique that users variable(with unknown correlations) to create a new set of variables called 'factors'(Sharma 1996) (27).

Examining the correlation among the studied factors revealed that there was significant overlap among various subgroups of factors. Next, with factor analysis it was possible to investigate the number of various subgroups and to identify what these subgroups represent conceptually.

There are fifty-four items in questionnaires and high

correlations among many of these items were observed, suggesting the appropriateness of data reduction techniques. To reduce variables, we began our investigation with the use of principal components analysis followed by varimax rotation for the thirteen indicators.

On 'Transaction cost theory', the factor analysis provided four factors with eigenvalues than 1.00(4.46, 2.11, 1.38, 1.10) . These four factors explained 64.64% of total variance. On 'Resource dependent theory', the factor analysis provided four factors with eigenvalues than 1.00(4.94, 2.08 ,1.27) . These three factors explained 55.23% of total variance. On 'Institution theory', the factor analysis provided two factors with eigenvalues than 1.00(3.56, 1.13) . These two factors explained 66.92% of total variance. On 'Contextual Influences', the factor analysis provided three factors with eigenvalues than 1.00(4.17, 1.95, 1.56) . These three factors explained 64.08% of total variance. On'Electronic Integration performance',the factor provide one factors with eigenvalues than 1.00(5.05) . This factor explained 63.15% of total variance.

Table 2 lists the alpha coefficients for the factor as well as the predicted alpha coefficients except 'Technological replacement'. Therefore, the below results suggest that the 'Technological replacement' factor that low homogeneous were deleted. On this background, it seemed appropriate to extract twelve factors in the present study.

Table 2 Alpha Coefficients

Factor	Alpha	Factor items
Transaction Cost Theory		
Dependence	0.782	5
Technological replacement	0.375	5
Transaction cost	0.778	3
Uncertainty	N/A	1
Resource Dependent Theory		
Resource dependent	0.794	6
Asset Specificity	0.806	7
Business Dependent	0.585	2
Institution theory		
Normative& Mimetic	0.791	4
Coercive	0.813	3
Contextual Influences		
National/regional	0.861	6
Socio-cultural	0.820	3
Structural	0.696	3
Electronic Integration Performance		
Integration performance	0.916	8

A further application of factor analysis uses the factors in a regression analysis. The regression coefficients obtained hereby would be more stable than the regression coefficients in the original variables. The eleven factors given above were independent in the regression model and Electronic Integration performance was dependent. Eleven factors explained 51.8% of the variability in data. Resource dependent, Business Dependent, Normative and Mimetic, Coercive, national and structural were significantly. The results are shown in Table 3.

Table 3 Regression Analysis

Factors	Coefficient	Prob.
Dependence	2.711E-02	.638
Transaction cost	3.154E-02	.616
Uncertainty	3.972E-02	.488
Resource dependent	.253	.000
Asset specificity	-9.351E-02	.187
Business Dependent	.159	.011
Normative & Mimetic	.305	.000
Coercive	.146	.038
National	.193	.005
Socio cultural	-5.418E-03	.928
Structural	-.218	.001

6. CONCLUSIONS

The data analysis result suggested that factors of institutionalization effect may be one of the most significant impact dimensions of B2B e-marketplace evolution. This result explains the difference of e-commerce development in seven industries. The stronger of the power structure in business partnership, the easier for the leading companies to integrate the industry value chain. Coercive, Mimetic and Normative of institutionalization effect will make the firms of the same industry reach the similar status in the B2B e-commerce.

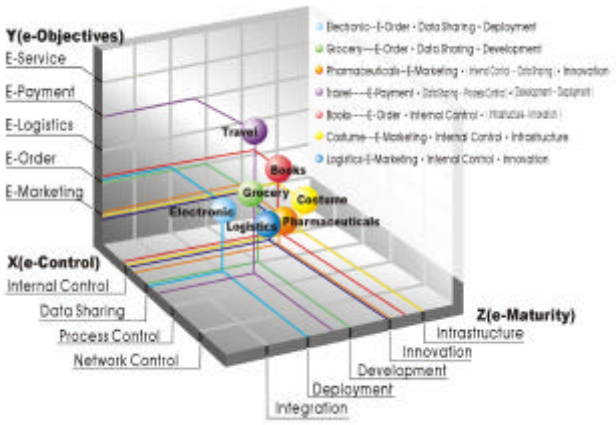

Figure 6. B2B e-Commerce Evolution Progress (The Samples of Seven Industries in Taiwan

The evolution model was modified to reflect the environment factors that might impact the adoption of B2B e-commerce. The final three dimensions model indicates that the objectives, the control levels and the maturity of the B2B e-commerce will differentiate the status of B2B e-commerce in different companies and different industries. The summary of the seven

industries position in the e-marketplace evolution is presented in figure 6.

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