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Cost and Benefit Analysis for E-Service Applications

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Abstract

Companies are adopting Internet-based electronic services (E-services) attracting customers, sharing of business information, maintaining business relationships and conducting business transactions. Companies in the earlier stages of employing E-services have little information and knowledge on its potential organizational and relational impacts. Through few years practice of E-services, companies have obtained related knowledge. They urgently need to assess the costs to move service online against the benefits received via adopting E-service, and identify the impact of E-service adoption in companies' relationships with their customers as a result of innovative use of E-services.

The initial objective of the research is to explore the relationships between cost factors, benefit factors and customer satisfaction for an E-service application. A further objective is to find a potential path for developing a customer oriented E-service application from its current implementation through identifying the types of changes taking place in the service functions and operations as a result of increased use of E-services. Though conducting a survey, this paper, as a stage report of the project, presents a research framework for E-service evaluation, identifies main cost and benefit factors of E-service and analyses the relationships between these factors. Finally, a cost benefit relationship model is proposed.

Keywords: E-services, Evaluation, Cost benefit analysis, Customer satisfaction, Assessment framework

1. Introduction

The Internet is being used as a platform through which services are delivered to businesses and customers [3]. Companies are adopting Internet-based electronic services (E-services) attracting customers, sharing of business information, maintaining business relationships and conducting business transactions. More recently, companies have started using the E-service as means to automate relationships between their business processes to allow customers to form alliances, joining their applications, databases, and systems in order to share their costs.

E-service applications in Australia have had rapid growth in past few years. International benchmarks consistently place Australia among the top ten countries in the world in the terms of adoption and use of E-business (E-service has been extraordinarily affected by the development of E-business). Through assessing connectivity, business environment, E-commerce consumer and business adoption, legal and regulatory environment, supporting an E-service, and social and cultural infrastructure, the US based Economist Intelligence Unit [6] published its second set of "E-business Readiness Rankings" for over 60 countries in May 2001, Australia was placed 2nd to the US [22]. As the results presented in 'The current state of play-June 2001' [22], 50% of Australian adults accessed the Internet in the 12 months to November 2000 and 37% of Australian households were connected to the Internet at November 2000 [21]. On business online use, 56% of employing businesses were connected to the Internet at June 2000 (an increase of 93% since June 1998). On the aspect of business E-service activity, the use of online banking and shopping by Australians has grown considerably. An estimated 13% of adults paid bills or transferred funds in the three months to November 2000 (an increase of 225% since November 1999), and 10% purchased or ordered goods or services via the Internet. The value of Internet-based E-service in Australia at June 2000 was estimated to be $A5.1 billion [22]. The ability of E-service to fulfill customers' demands for service is helping businesses to reduce costs and obtain benefits. Service is an important measure of success in competitive markets and the Internet marketplace will be no exception. As researchers noted, E-business success is determined less by business models than by delivering topnotch, repeatable service that creates satisfied customers [19].

Recent reports concerning the quality, usability and benefits of E-services have led researchers to express increasing interests in conducting evaluation for E-services [9]. These studies used various research methods, such as survey, case study and conceptual modelling, to conduct research in E-service websites or applications assessment, evaluation frameworks, cost/benefit analysis and customer satisfaction measurement. Ng et al. [20] reported a desk survey of business websites and discussed the benefits of Internet. Giaglis et al. [7] presented a case study of E-commerce investment evaluation by developing a model of E-

commerce business value. Tang et al. [25] proposed a conceptual model to demonstrate the rationale of the buyer-supplier interaction with the information service provider's mediation in the E-commerce environment. Lee et al. [13] created a framework for evaluating the business value of Internet-based B2B E-service through five propositions. Helander and Khalid [11] used a system model to illustrate the relationships between three subsystems in E-commerce: store environment, customer and web technology. Drinjak, Altmann & Joyce [5] investigated the perceived benefits of investing in E-service applications. More recently, Hahn et al [10] summarized three major traditional approaches to E-commerce website evaluation: testing, inspection and inquiry, and presented a value-driven framework for E-commerce website evaluation.

However, exist evaluation models and frameworks from literature have orientation either from a web customer perspective or web supplier perspective only. The project intends to explore the relationships between customer perspective and supplier perspective for specific E-service applications. This project attempts to develop a conceptual framework to evaluate E-service applications by identifying the relationships among E-service functions, customer satisfaction for E-service applications, business benefits received via adopting E-service and costs to move service operations to online. It will then identify the types of changes taking place in the service functions and operations as a result of increased use of E-service, examine the impact of increased sharing of information via online collaboration between companies and their customers on management approaches. The research results will be expressed into a factors relationship model. Based on the model, recommendations for developing and maintaining E-service applications will be proposed, which will have the potential to improve the competitiveness, flexibility and strategic planning of companies engaging in E-service by reducing costs, increasing benefits and making E-service activities better.

This paper, as a stage report of the project, describes the research framework in Section 2. Research methodology used in the study is given in Section 3. Section 4 analyses main cost benefit factors and their relationships for the development of an E-service application, and then expresses the findings into a cost benefit relationship model.

2. Research Framework

Based on the pervious works shown in Lu at el [17], Lu [15, 16] and a broad range review of literature (such as [5] [8] and [23]), four categories are identified to compose a conceptual research framework for assessing E-service applications. The four categories are E-service function (F), E-service cost (C), E-service benefit (B) and customer satisfaction (S)(FCBS). *E-service function* concerns with the capability and quality of E-services. *E-service cost* concerns with the costs of adopting E-services. *E-service benefit* concerns with the benefits received through employing E-services. *Customer satisfaction* is about the results of individuals taking outcomes that have been received. Each category consists of a set of factors.

The number, types and functions of E-services increase day by day and E-services are typically delivered individually. In *E-service function* category, typical function factors include general information publicity, email require, delivery of customized information, advertising products and price, online ordering/booking and on-line transaction. These functions also imply the levels of E-service complexity. For example, online payment has higher level than only advertising products. Each E-service application may contain several or all of these functions.

Drinjak, Altmann & Joyce [5] listed a number of benefit items within three categories of web applications and their rankings. These items include: providing access 24 hours a day and seven days a week (24*7), effective promotion of the company together with the products and services it produces, enhance quality and speed of customer service, create competitive advantage and subsequently avoid competitive disadvantage, entice shoppers and encourage customer interaction, supporting core business functions which are integral to business strategy, provide new business opportunities, increase market presence and facilitate on-line purchasing. The research also indicated that the item access 24*7, effective promotion of the company, enhancing customer service, supporting core business functions, and providing new business opportunities have relatively high rankings. Lu [16] listed 21 benefit factors and identified eight factors as the core benefit factors through a survey conducted in New Zealand. They are: accessing to a greater customer base, broadening market reach, lowering of entry barrier to new markets and cost of acquiring new customers, alternative communication channel to customers, increasing services to customers, enhancing perceived company image, gaining competitive advantages, and potential for increasing customer knowledge. Based on the two research results, 16 main E-service benefit factors are identified and used in the study.

Lu [16] also tested 19 cost factors and identified eight core costs factors: expense of setting up applications, maintaining applications, internet connection, hardware/software, security concerns, legal issues, training and rapid technology changes. The eight cost items are used in the study as cost factors.

E-service is altering the way in which businesses operate and interact with customers. One of the major challenges companies face today is to meet increasing

customer demands, including efficient processes and improved customer services. The judgment on the quality of service has been shifted from the business to the individual customers. Customer satisfaction has become one of the dominant factors to E-service success [4]. As Terry & Standing [26] observed 'while there is no direct measure for the success of an information system, empirical researchers have commonly used user satisfaction as the dependent variable'. A successful E-service is one that attracts customers, makes them feel the service is trustworthy, dependable, reliable, and satisfactory [14] [12].

Generally there are three types of customer measures to be used: the relative importance of attributes, dimension of customer satisfaction and added customer value [1]. *Attribute importance* means every service attribute contributes diversely to the overall satisfaction of the customers. *Dimension of customer satisfaction* means every dimension of satisfaction gets its own score, which then can be compared to evaluate the strengths and weaknesses of the applications. *Added customer value* is generated through dividing the business' overall customer satisfaction by the scores of all businesses competing in a certain market. This project applies a composition of the three types of customer measures in customer satisfaction category. It includes information content satisfaction, usability satisfaction, security satisfaction, convenience satisfaction, efficiency satisfaction and flexibility satisfaction. Each of the factors may imply more detail criteria. For example, usability satisfaction involves user satisfaction in information up-to-date, clear language style and links to appropriate resources. E-service website format design, facilitated browsing, search engine provided, accessing speed and customer control of a transaction process [24] are considered as sub-criteria for convenience satisfaction.

Figure 1 shows the factors of E-service function, cost, benefit and customer satisfaction, called FCBS research framework.

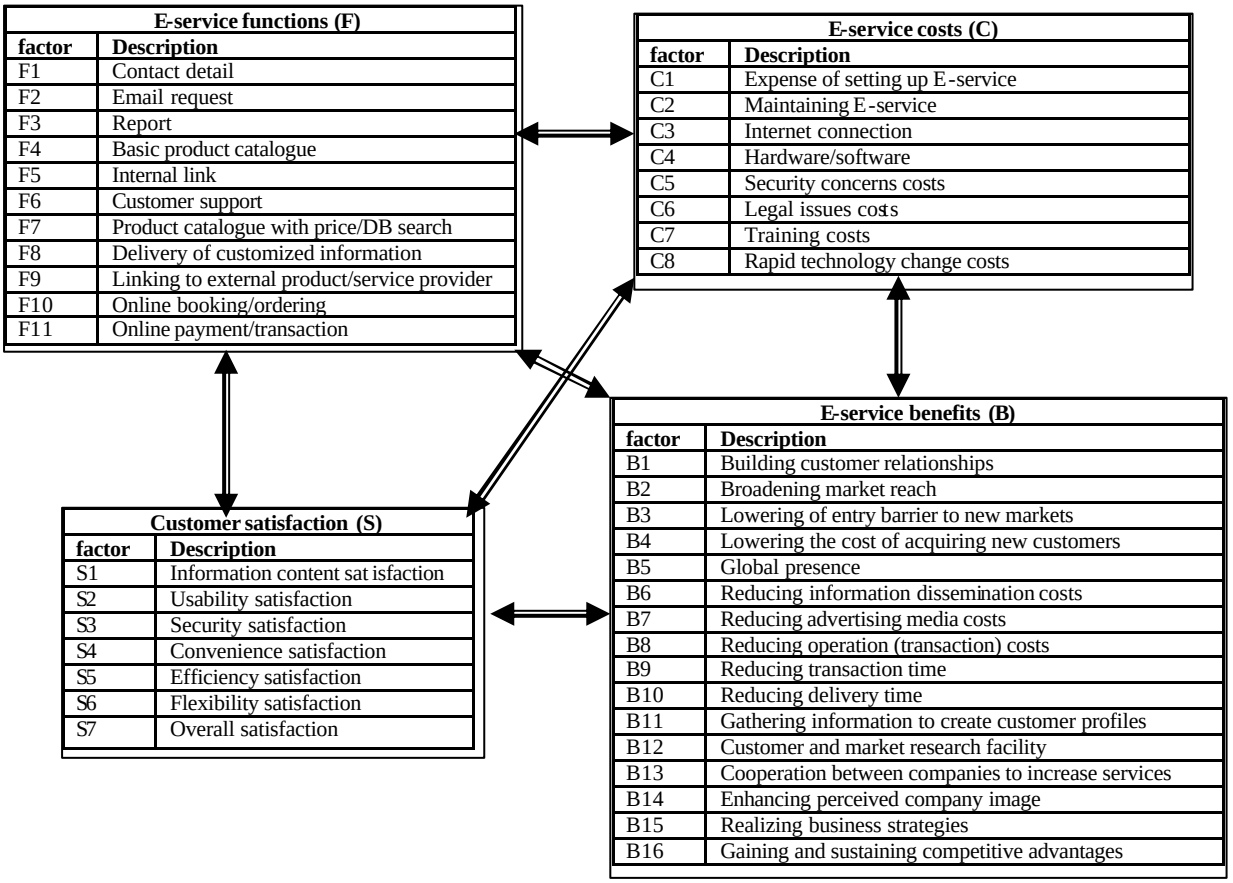

Fig. 1 FCBS research framework with factors

3. Research Methodology

This study focuses on two main industry sectors: Tourism/Travel and IT/Communication services in Australia. This study needs to conduct a company (E-service provider) oriented survey and a customer oriented survey respectively. It then explores the relationships among survey results by using statistical analysis method. Why the project develop two surveys is that it needs to get customer satisfaction from customer side and company cost benefit assessment from company side. The statistical analysis aims to find useful aggregation results in investigate dependency and correlation relationships between factors shown in the research framework. The surveys assume that respondents represent their colleagues and should not be asked directly about hypotheses.

In order to identify company sample a ***web search*** was first conducted. The purpose of the web search is to find which companies have adopted E-services on an appropriate level and get volunteers from these companies. A total of 100 websites were randomly selected from the company websites registered in the Yellow Pages Online (NSW, Australia) http://www.yellowpages.com.au, under Tourism/Travel and IT/Communication categories, conditional on their reaching for an appropriate level of E-service development. The sample companies involved a number of industry sectors: Accommodation, Community Services, Information Technology, Retail, Transport, Attractions and Travel Agents.

A ***company-oriented questionnaire survey*** was conducted in the sample companies from February to March 2002. As a pre-test survey, an initial questionnaire was sent to three subjects aimed getting responses' feedback. Based on the pre-test results, the questionnaire was refined. The finalized questionnaire was then posted/emailed/faxed to the 100 selected sample companies. Out of 34 questions in the questionnaire, eight items are related to E-service functions and development, 10 are related to the costs of setting up and maintaining E-service applications and 16 are related to business benefits of E-service applications. A total of 50 responses were obtained and the results shown in this paper is based on 48 completed responses. All questions listed in the questionnaire use five-point Likert scales or giving a statement that is responded by choosing or not choosing. This survey attempts to identify why companies adopt E-service applications, how do evaluate an E-service application, what are the main benefit factors and what kinds of benefits have been obtained, what are the major costs and barriers towards E-service applications, and how the relationships are changing between E-service costs and benefits.

Finally, ***a customer-oriented survey*** was conducted in September 2002 to identify customers' major facilitators and barriers in relation to receive E-services, customers satisfaction in information content, usability, security, convenience, efficient and flexibility for E-services. By the length limitation, the paper only shows the results conducted in the company oriented survey.

4. Data Analysis

4.1 Why do companies adopt E-service applications?

The survey results show that the 48 companies sampled have employed Internet doing E-service for 3.1 years on average. There are 49% of the companies sampled indicate the reason to develop E-services is 'currently it is the way to do business', 27% indicate that their competitors are adopting E-services, 41% mention that their customers want E-service based business relationships, and 73% explain that doing E-services is a part of their organization's strategies. Some companies gave more reasons for doing E-services such as this is 'another way to reach new customers', 'online knowledge management' and 'E-service is a cost-effective solution'. One company indicates the reason is that 'we are an Internet technology company'.

4.2 Are companies satisfied with their current E-service applications?

Out of the 48 sampled companies, about 26% of sampled companies think that their E-service applications are 'very successful', 36% of 'successful', 28% of 'moderate', 8% of 'very little' and only one company marked 'not beneficial'. The result shows that most companies are satisfied with their E-service development.

The data shows that about 40% of E-service applications were developed by in-house staff, 20% by web developers or contractors, and 39% by both internal and external people. Through comparing the 'successful' level in the three groups of websites, there is no significant difference in satisfaction levels for E-service applications developed among different groups.

This survey also explored the barriers when company adopting an E-service application. 35% of companies sampled indicate that 'lack of staff expertise' is one of main barriers. 33% indicate 'difficulty in integrating web with internal applications' is a main barrier. 'Expense of setting up E-service' is marked as one of main barriers by 41% of companies. 'Expense of maintaining E-service', 'Lack of adequate training', 'Lack of web capable business partners', 'Resistance to structural changes within your company', and 'Security problems associated with using E-service' are marked as barriers by 16%, 12%, 6%, 14% and 16% of companies respectively. This result shows that expertise, technique, and expenses are still main barriers for E-service development.

It is found that companies that mark their E-service applications as ‘very little benefit' or ‘not beneficial' almost mark 'expense of setting up web-based E-service applications' and 'difficulty in integrating web with internal applications' as main barriers. This finding means obviously that such companies must overcome barriers in setting up and integrating E-services to obtain ideal benefits.

4.3 What functions are provided in E-service websites?

Totally 11 function factors listed in Figure 1 were tested. The results show that over 90% of sample companies provided contact details, reports, basic product catalogue and internal links. About 40% of companies offered online booking and 67% made product catalogue with price/DB search available. Only three companies kept sending information to customers and only seven allowed online payment.

What factors/functions are more important to online customers in their decision to purchase at a website? The survey shows that 51% of companies sampled thinks 'guarantees transaction security' is an important factor. 49% of indicate 'guarantees services or products offered' is important. 67% of indicate 'provides useful information' and 59% of expresses their concerns on 'provides user-friendly navigation to information'. There are 59% of companies marking 'provides fast service' and 35% of 'provides lower cost than traditional methods'. About 33% of companies mentions that 'provides more options to customer services or products selection' is one of important factors.

4.4 What are the main benefits for adopting an E-service?

The questionnaire is designed to cover proposed factors at an appropriate level and with an appropriate form. The respondents were asked to indicate their present benefits assessment and ideal rating for each of the benefit factors. The current benefit assessment is regarding to the assessment of the status of respondents' E-service application, comparing with where they would ideally like it to be. The ideal rating for benefit factors is tested on a 5-point scale. Here ‘1' means not important at all, and ‘5' very important. For example, if a company considers that one of the most important benefits is to enhance perceived company image, the company would score perhaps 5 on the Ideal Rating of factor 'enhancing perceived company image'. Table 1 shows the result of ideal rating for benefit factors. It is found that B14 (Enhancing perceived company image), B16 (Gaining and sustaining competitive advantages), B1 (Building customer relationships), B2 (Broadening market reach), B15 (Realizing business strategies) and B4 (Lowering the cost of acquiring new customers) received higher scores respectively. These factors are thus identified as major benefit factors. That means businesses have a higher expects to get benefits on these aspects.

Table 1: Ideal rating for benefit factors

Ideal rating	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16
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	47	2	1	1	1	1	2	1	4	3	3	3	2	2	2
AV	**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**

4.5 What benefits have been obtained through developing an E-service application?

Companies are all interested in maximizing business value of E-services. They have made business strategies to address the requirements of interoperability, quality of customer service, evolution and dependability. They expect to know what factors are affecting E-service benefits and how E-service can increase real business benefits, by comparing its costs with those of the associated investments. In order to complete such analysis, this study not only explores which benefit factors are more important to business benefit and also seeks to find in which aspects companies have obtained higher benefits, and which one is lower. The 5-point scale is also used for present benefit assessment: 1-low benefit, 5-very high benefit. For example, if a company considers that currently E-service only build very basic customer relationships but the company would ideally prefer to build more closed relationships with customers. Then the company would score perhaps 3 on the present benefit assessment for B1. The assessment result shown in Table 2 indicates that companies have obtained higher benefits on B14 (Enhancing perceived company image), B16 (Gaining and sustaining competitive advantages), B1 (Build customer relationships) and B2 (Broadening market reach).

Table 2: Current benefit assessment

Benefit assessment	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16
1	2	1	6	4	9	5	6	7	7	7	10	9	7	1	3	2
2	7	6	13	14	10	8	7	7	10	9	7	12	8	5	7	8
3	16	21	18	14	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	6	8	5	6	7	9	9	5	5	6	17	7	10
NA	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0
AV	**3.4**	**3.4**	**2.7**	**3.0**	**3.0**	**3.1**	**3.2**	**3.0**	**3.1**	**3.1**	**2.9**	**2.6**	**3.1**	**3.8**	**3.3**	**3.5**

4.6 What are the main cost factors for adopting an E-service application?

Same as benefit factor identification, this study identifies major cost factors by 5-point scale: 1- not important at all, 5- very important. For example, if a company thinks the cost of maintaining an E-service is not important it should mark the degree of importance as 1 or 2. Table 3 shows that C2 (Maintaining E-services) is the most important factor and C5 (Security concerns costs) is the second as they received a high average value (3.9, 3.7). This finding implies that companies have had or would have higher investment on these important cost items.

Table 3. Weights of cost factors

weight	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
1	4	1	4	2	3	8	4	4	4	5
2	6	7	8	5	7	6	9	4	2	4
3	10	7	12	13	7	10	10	15	13	17
4	13	15	11	16	10	11	17	14	20	12
5	14	17	12	9	18	10	5	10	8	9
N/A	0	0	0	2	2	2	2	0	0	0
AV	**3.6**	**3.9**	**3.4**	**3.6**	**3.7**	**3.3**	**3.2**	**3.5**	**3.6**	**3.3**

4.7 What costs are higher than estimated in developing an E-service application?

This study also explores which items cause a higher cost, and which one lower. Here '1' means very low cost, and '5' very high. The assessment result is shown in Table 4. It is found that there are higher costs on C9 (time spent on E-service development) and C1 (expense of setting up E-service) in the sampled companies.

Table 4. Current cost assessment

cost	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
1	6	6	15	5	7	9	9	8	6	6
2	5	10	13	7	9	12	9	7	3	8
3	10	12	11	16	9	11	15	9	13	14
4	17	16	7	12	13	8	10	19	14	14
5	9	3	1	7	7	4	2	3	10	4
N/A	0	0	0	0	2	3	2	1	1	1
AV	**3.4**	**3.0**	**2.3**	**3.2**	**3.1**	**2.7**	**2.7**	**3.0**	**3.4**	**3.0**

4.8 What cost factors affect E-service benefits?

In order to exam the relationships between individual cost and benefit factors, a number of hypotheses are designed [18]. This paper only presents three hypotheses and discusses related test result details.

H1: There is a significant difference in the benefit *'Broadening market reach'* (B2) for different groups of companies that have different levels in the cost of *'Maintaining E-service'* applications (C2).

H2: There is a significant difference in the benefit *'Gaining and sustaining competitive advantages'* (B16) for different groups of companies that have different levels in the cost of *'Maintaining E-service'* applications (C2).

H3: There is a significant difference in the benefit *'Enhancing perceived company image'* (B14) for different groups of companies that have different levels in the *'Legal issues costs'* (C6).

Let *'Maintaining E-service'* (C2) be an independent variable with five levels, *'Broadening market reach'* (B2) and *'Gaining and sustaining competitive advantages'* (B16) be dependent variables. Let *'Legal issues costs'* (C6) be an independent variable with five levels, *'Enhancing perceived company image'* be a dependent variable. Three one factor fixed effects ANOVA models (1), (2) and (3) were built to determine the effect of the independent variables on the dependent measures in individuals.

$$[Broadening\_market\_reach]_i = a_i + [Maintaining\_E\text{-}service]_i + e_i \quad (1)$$

$$[Gaining\_compet\_advantages]_i = a_i + [Maintaining\ E\text{-}service]_i + e_i \quad (2)$$

$$[Enhancing\_perceived\_company\_image]_i = a_i + [Legal\_issues\_costs]_i + e_i \quad (3)$$

The ANOVA results show that the *'Broadening market reach'* and *'Gaining and sustaining competitive advantages'* are significantly different across different groups of the cost of *'Maintaining E-service'* ($p<0.05$ in Table 5 and 6). The findings mean that the E-service applications where company spent more time on maintenance will contribute directly to the benefit factors *Broadening market reach'* and *'Gaining and sustaining competitive advantages'*. The result supports H1 and H2. However, Table 7 shows that the *'Enhancing perceived company image'* is not significantly different across different groups of the cost of *'Legal issues costs'*. It is not support H3's claim.

Table 5. Summary & ANOVA results for the effects on *Broadening market reach* (B2)

Cost 2 groups	Cont	Sum	Ave	F	P-value
C2=1very low	6	21	3.5	2.7	0.0461
C2=2	10	27	2.7		
C2=3	12	43	3.5		
C2=4	16	55	3.4		
C2=5very high	3	14	4.6		

Table 6. Summary & ANOVA results for the effects on *Gaining and sustaining competitive advantages* (B16)

Cost 2 groups	Cot	Sum	Ave	F	P-value
C2=1 verylow	6	16	2.7	5.3	0.0015
C2=2	9	27	3.1		
C2=3	12	36	3		
C2=4	16	67	4.2		
C2=5 veryhigh	3	14	4.7		

Table 7. Summary & ANOVA results for the effects on *Enhancing perceived company image* (B14)

Cost 6 groups	Cont	Sum	Ave	Source of variation	df	MS	F	P-value
C6= 1 very low	9	34	3.78	Between Groups	4	2.7	2.4	0.0643
C6= 2	12	40	3.38	Within Groups	38	1.1		
C6= 3	10	43	4.3					
C6= 4	8	36	4.5					
C6= 5 very high	4	12	3					

By using ANOVA model to test other hypotheses, a set of relationships between cost and benefit factors are explored. The results are presented in a cost benefit relationship model (Figure 2). The lines in the model express dependency relationships between related factors.

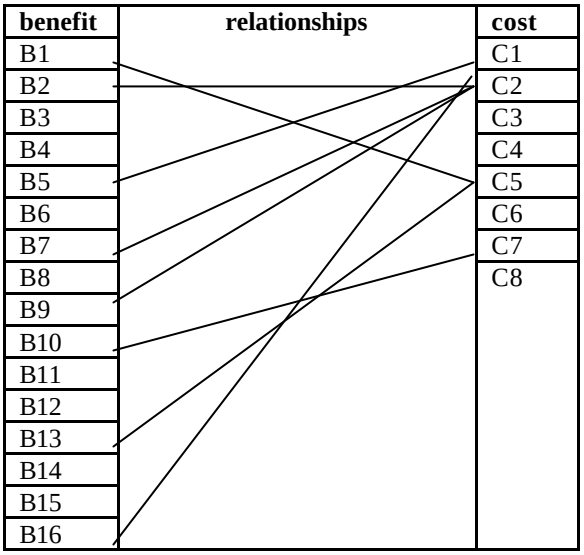

Fig. 2. Relationships between cost and benefit factors

5. Further Research

This study is applying Structural equation modeling method [2] to analyze the relationships between multiple cost benefit factors.

This study has just completed a customer oriented survey. Data analysis is being completed to test those hypotheses that relevant to customer satisfaction. For example, in order to explore whether or not customer satisfaction is dependent on cost item 'maintaining E-service', let 'customer_satisfaction' be an independent variable and 'maintaining_E-service' a dependent variable, then test the effect of *customer satisfaction* on the *maintaining E-services* in individuals.

Through testing more hypotheses, findings will be presented into an integrated E-service factor relationship model (Figure 2 is a part of the model) which involves all the relationships among the four groups of constructs shown in FCBS research framework: *E-service functions, costs, benefits and customer satisfaction, with kinds of relationships: dependent, correlated and non-correlated*. The relationship model is intended as a mechanism for clearly identifying options, opportunities and their implementations for E-service development. The findings shown in the relationship model will have the potential to help companies to improve the competitiveness of companies engaging in E-services by reducing costs, increasing benefits and improving E-service quality. Based on the findings, the project will propose recommendations for designing, maintaining and improving E-service to take full advantages of Internet.

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