行政院國家科學委員會專題研究計畫 成果報告

建構E化服務之顧客價值衡量模式研究
研究成果報告(精簡版)

計 畫 類 別 ：個別型
計 畫 編 號 ：NSC 99-2410-H-032-046-
執 行 期 間 ：99 年 08 月 01 日至 100 年 07 月 31 日
執 行 單 位 ：淡江大學企業管理學系

計 畫 主 持 人 ：張瑋倫

報 告 附 件 ：出席國際會議研究心得報告及發表論文

處 理 方 式 ：本計畫可公開查詢

中 華 民 國 100 年 09 月 09 日

附件一

行政院國家科學委員會補助專題研究計畫 ■成果報告 □期中進度報告

建構E化服務之顧客價值衡量模式研究

計畫類別：■個別型計畫　□整合型計畫
計畫編號：NSC 99-2410-H-032-046
執行期間：　2010 年 8 月 1　日至 2011　年 7 月 31　日

執行機構及系所：淡江大學企業管理學系

計畫主持人：張瑋倫
共同主持人：
計畫參與人員：林子翔、林俞均、張雁婷、狄愛林、黃保勝、張慧琪、陳暐岳

成果報告類型(依經費核定清單規定繳交)：■精簡報告　□完整報告

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■出席國際學術會議心得報告
□國際合作研究計畫國外研究報告

處理方式：除列管計畫及下列情形者外，得立即公開查詢
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中　華　民　國　100　年　9　月　1　日

Revisiting Customer Value for Recommending Customer Relationship Management E-Services

Wei-Lun Chang
Department of Business Administration
wlchang@mail.tku.edu.tw

Abstract

Many business opportunities and special services have been created due to the emergence and popularity of the Internet. However, information transparency and low transformation cost have resulted in a decrement of customer loyalty. In the past, firms focused on stimulating consumption and acquiring customers while neglecting the significance of customer retention. This study delaminated customer value based on previous literature and blended the evolution of the CRM concept to build a customer value model. Meanwhile, this work applied a Markov Chain and Bayesian theorem to forecast and recommend appropriate CRM e-services to customers. This study used Apple iTunes as a case study to verify performance from simulation. The results showed that the number of samples and customer type are critical factors affecting the validity of the Markov Chain. Additionally, the performance of the Bayesian theorem for forecasting and recommending appropriate CRM e-services is insignificantly influenced by customer type and sample. The proposed model diminished the risk for recommending inappropriate CRM e-services as well as avoided resource wasting based on customer needs.

Keywords: Markov Chain, Bayesian Theorem, CRM, E-Service

1. Introduction

Due to the new development of the Internet, consumer behavior has changed and new needs have emerged. Enterprises devoted to combining new technologies with traditional service concepts have created a new type of service, called e-service. According to Järvinen and Lehtinen (2007), e-service delivers certain intangible products and services by interacting with online users. On the other hand, the Internet impacts the way companies provide services and business strategies. Firms attempt to deliver products or services electronically to enhance operation efficiency and profit (Pan and Lee, 2003). In particular, the application of customer relationship management (CRM) has become a popular e-service issue. The traditional way to contact customers has been replaced by e-mail, online self-service, or new types of e-services. Reichheld and Sasser (1990) indicated that profit will be enhanced 25 % to 80 % by increasing customer loyalty by 5 %. The cost to discover a new customer is 6 to 7 times more than retaining existing customers. Thus, the significance of electronic CRM has been addressed gradually.

According to a report from Bain & Company (www.bain.com), the average annual rate of customer loss is around 20 % to 30 % for US enterprises. Even for top 500 enterprises, at least half of the customers are lost every five years. This phenomenon reveals that most customers are dissatisfied after consumption and transfer to other suppliers. Hence, enterprises need to understand their customers' needs faster and collect intelligence more efficiently than their competitors. Existing e-CRM literature mostly investigates the e-CRM activities or services companies need to provide, based on an enterprise perspective, to attain high satisfaction and loyalty (Globerson and Maggard, 1991; Dabholkar 1996; Meuter *et al.*, 2000) as well as the resources and technology that increase CRM benefit (Bhatt 2001; Grandon and Ranganathan, 2001; Sivakumar 2002). However, combining the research of enterprise and customer perspectives to investigate how to satisfy customer need by e-services is still lacking. Consequently, this research aims to examine how to predict and satisfy customer

needs efficiently to retain customers. Brown (2000) indicated that 67 % of online transactions are incomplete due to the lack of real-time and appropriate e-services. Pritchard and Cantor (2000) specified that satisfying customer expectation is one of the e-CRM challenges for firms. To revise business strategy, companies need to completely recognize customer expectations and examine the differences between perception and expectation. Hence, this study divides the research question into two sub-questions. The first question addresses how to differentiate customer value into various levels based on customer needs. The second question addresses how to provide accurate e-services based on predicted customer needs. Consequently, this study aims to: (1) revisit the value of e-services into levels based on customer usage; (2) propose a customer value framework to connect customer needs and CRM e-services; and, (3) predict customer needs and furnish combined CRM e-services through the Markov chain and Bayesian approaches. The goal of this research is to assist companies with enhancing customer satisfaction and loyalty in respect to e-CRM issues.

2. Method

2.1 A Customer Value Framework

Concept		Pre-Sale / Transaction / Post-Sale			
Process for Creating Customer Value		Acquire	Use	Feedback	Retain
Process for Creating Business Value		Marketing	Sale	Post-Service	Revise
		CRM E-Service Process			
Level of Customer Value		Attract	Interact		Retain
Surprise from customers (CRM 3.0 concept: Self-problem solving and self -control)	Self-actualized value (Unexpected Value)	*Products and services provide self-actualized value.*	*Customer-centric radiation* B C		*Customer domination*
Satisfaction from customers (CRM 2.0 concept: Value co-creation from social network)	Social and emotional value (Desired Value)	*Products and services provide belongingness.*	*Two-way interaction* B ⟷ C		*Social and emotional satisfaction*
Comprehensiveness from customers (CRM 1.0 concept: E-service standard)	Added value (Expectant Value)	*Products and services are comprehensive.*	*One-way communication* B → C		*Completeness*
Usefulness from customers (CRM 1.0 concept: Basic functions of e-services)	Functional value (Basic Value)	*Products and services provide functional value.*	*Closed* B C		*Perceived usefulness*

Figure 1. Customer value framework.

Figure 1 shows the utilization of customer value and CRM e-service process as two major dimensions for constructing a customer value creation model. The lowest two levels of customer value are functional and added value, which enfold the concept of CRM 1.0. In the past, CRM 1.0 allowed merely closed or one-way communication. The third level is social and emotional value, which is enhanced to the CRM 2.0 concept. CRM 2.0 allows value co-creation and is a type of two-way interaction. In this level, companies provide e-services that fulfill customer desired value and perceived belongingness from customers. The highest level is self-actualized value, which is also the expected value to customers. At this level, customers expect surprises from companies, so the concept is promoted to CRM 3.0. CRM 3.0 allows customers to solve problems on their own and furnish suggestions and comments for improving e-services sustainably. At this level, customers dominate the process of CRM and help companies to retain most of their customers and create profits.

2.2 Prediction of Customer Value

In this section, we use the Markov Chain approach to predict the level of customer value. Proposed by Markov in 1970, the Markov process is a process of probability that uses historical data to predict further status. The definition is a chain of states, which are described by stochastic processes. This research uses first-order (the number of past state to affect prediction), finite (the number of state is finite), and regular Markov Chains. Each consequence represents a state. This research aims to apply CRM to the e-services industry. However, consumer behavior is difficult to predict due to the features of e-services. This study attempted to combine the notion of the Markov Chain to forecast the level of customer value. This research considered customer value as a continuous and dynamic process. We attempted to discover a series of consumer behaviors and identify the level of customer value for each transaction (e-service). First, the initial probability of the transition matrix (P) is generated by existing transactions. Next, n steps for transition matrix (n = 1, 2, 3, 4, steady-state) are estimated. Finally, the product of initial probability and transition matrix estimates the probabilities, which is also the possible future state.

2.3 Recommendation of CRM E-Service

This research study used the Bayesian theorem to provide appropriate CRM e-services based on the identified level of customer value. Each level of customer value may provide a combination of CRM e-services in terms of attract, interact, and retain. Different customers have various preferences, which result in distinct e-services. This research applied the concept of the Bayesian theorem to predict the CRM e-service combinations. Certainly, different customers may have different recommendations for combinations. In short, this research aimed to apply the Bayesian theorem to discover accurate and appropriate CRM e-services based on user behavior.

3. Results

3.1 Case Illustration and Performance Indicators

This study selected iTunes of the Taiwan region as the e-service platform for further verification. The reason is the number of users is sufficient for investigation and e-services are broad. iTunes is a famous and popular platform for customers to download music, movies, TV programs, podcasts, and other applications. This research applied the proposed CRM framework to relate concepts to e-services in iTunes. This research also provides indicators for assessment. The indicators can be divided into two aspects: accuracy of the Markov chain prediction and adequacy of the Bayesian theorem forecast. This study utilized three indicators to evaluate the accuracy of the Markov Chain approach: precision, recall, and F-measure. Evaluation indices, such as precision, recall, and F-measure, are widely used in the information retrieval domain. In addition, this research used adequacy to measure the performance of the Bayesian theorem. Adequacy is the percentage of actual usage of e-services based on all predicted e-service.

$$\mathrm{Pr}\mathit{ecision} = \frac{\text{predicted and ideal value}}{\text{all value predicted}} \quad \text{(1)}$$

$$\mathrm{Re}\mathit{call} = \frac{\text{predicted and ideal value}}{\text{out of all ideal value available}} \quad \text{(2)}$$

$$F\text{ - }measure = \frac{2 \times \text{Precision} \times \text{Recall}}{\text{Precision} + \text{Recall}} \quad \text{(3)}$$

$$\text{Adequacy} = \frac{\text{actual usage of e-services}}{\text{all predicted e-services}} \quad \cdots \quad (4)$$

3.2 Customer Segmentation and Assumptions

This research study interviewed 30 iTunes users (including 15 students and 15 workers) who have experience using online iTunes services, and collected information on their behaviors. The study discovered that students and workers are apparently distinct in paying for e-services. User preference (e.g., music involvement) is also a factor affecting e-service usage. Thus, this research study used economic ability and involvement of music to segment the 30 users into four types. As shown in Table 3, study participants were divided into addicted student (7), typical student (8), addicted worker (6), and typical worker (9). In addition to customer segmentation, this study also collected information on real-time behaviors over a specific time period (13 days), and attempted to match each used e-service to a level of customer value. Moreover, based on the study interview, it was assumed that each user used an e-service per day on average. Due to the difficulty in obtaining long-term user behavior data, this research assumed that user behaviors are routine. Therefore, long-term data was simulated based on 13 days. In other words, samples were extended to 26, 39, 52, and 65 days.

3.3 Simulation and Analysis

3.3.1 Markov Chain Prediction

The results of the simulation revealed 52 data has the best outcome for precision, recall, and F-measure (Table 5). In particular, precision rates were 70.59 % for the typical student and addicted worker, 64.71 % for the addicted student, and 50 % for the typical worker. The average precision rate percentage was 64.7 %. The recall rate numbers were 66.7 % for the typical student, 69.57 % for the addicted student, 57.41 % for the typical worker, and 78.26 % for the addicted worker. Average recall rate percentage was 61.48 %. The F-measure for the 52 data was 67.91 %, which was the best value among all simulated data. The results also revealed that the precision rate was high for the typical student and addicted worker, which reached 60 % to 70 % among the different data. These two types of users had the highest and lowest music involvement. The results of recall rate for all data numbers was 57.5 % (26), 62.5 % (39), 71.97 % (52), and 61.84 % (65). Finally, the F-measure for all data numbers was 3.11 % (26), 60.71 % (39), 67.91 % (52), and 58.20 % (65). This result also showed that the ability to predict customer value for the typical student and the addicted worker was best and the typical worker was the worst when the number of data was 52. The F-measure number for the addicted student was in between.

3.3.2 Bayesian Approach Forecast

From the perspective of data size, 39 and 52 data for levels B and C of the typical student had high adequacy. The addicted student with 52 data had high numbers of adequacy for all levels. The typical worker for level B had good adequacy when the data was 26 and good adequacy for other levels when the data was 65. The numbers of adequacy for all levels of the addicted worker were good when the data was 65. In short, the typical student and the addicted student had superior adequacy when the data was 52 and the typical worker and the addicted worker had superior adequacy when the data was 65. Consequently, the size of data affected the performance of adequacy. The performance of the Bayesian approach was superior when the number of data increased. From the perspective of customer type, adequacy of level B was around 80 % for all customer types. The adequacy of level C was around 85 % for all customer types and level E had 70 % to 80 % adequacy for all customer types. In particular, the adequacy for level E was not sufficiently representative due

to less data (only the addicted worker used e-services from this level). Thus, different types of customers had less impact on the performance of the Bayesian approach. In summary, the Bayesian approach provided around 70 % to 90 % of adequacy in this research, indicating stability and validity.

4. Conclusion

This research study investigates how to interact with customers efficiently and handle customer needs. Based on the research goals, this study separates customer needs into levels according to existing literature on customer value and embeds CRM processes to build an Internet-enabled CRM e-service framework. We aim to utilize the Markov Chain approach to predict customer value and the Bayesian approach to forecast appropriate CRM e-services. This study also applies iTunes as a real world case study to verify the validity of the proposed framework. We collect data from iTunes users and synthesize the data into 13 behavioral points. Due to the difficulty in collecting long-term data, we extend 13 behavioral points to 26, 39, 52, and 65 for simulation. Results from simulation reveal that the accuracy of the Markov Chain is around 60 % to 70 % in terms of precision, recall, and F-measure. The number of data is also important for prediction; in particular, 52 is the optimal number for prediction (2 months of behavioral points). Different customer types have different optimal numbers of data for prediction. Moreover, the result also reveals adequacy is superior for all customer types, which means that different customer types have no direct impact on adequacy. The optimal number of data for superior adequacy of typical and addicted students is 52. For typical and addicted workers, the optimal data number is 65. The performance of the Bayesian approach increases when the number of data increases. In sum, this research provides a clue and basis for future research to identify the right value (needs) at the right time and to provide the right CRM e-services to the right customers.

References

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附件四

國科會補助專題研究計畫項下出席國際學術會議心得報告

日期：___年___月___日

計畫編號	NSC 99-2410-H-032-046		
計畫名稱	建構 E 化服務之顧客價值衡量模式研究		
出國人員姓名	張瑋倫	服務機構及職稱	淡江大學企業管理學系
會議時間	99 年 12 月 11 日 至 99 年 12 月 14 日	會議地點	Saint Louis, Missouri, USA
會議名稱	Pre-ICIS (9th) Workshop on eBusiness (WeB 10)		
發表論文題目	Revisiting Customer Value for Recommending Customer Relationship Management E-Services		

一、參加會議經過

ICIS 之 Pre-workshop 已舉辦數年，對於電子化相關議題探討相當深入，本篇論文於研討會中發表，過程經主席與與會者討論後，給予許多寶貴的建議，對於電子化服務的議題想當肯定。也鼓勵在未來相關研究中能夠嘗試更多電子化議題的文章探討。

二、與會心得

在 session chair 的鼓勵下，本研究獲得相當多肯定，與會者也都針對電子化服務的顧客價值議題提供許多寶貴意見，針對所使用的方法也都給予修正的意見，包含馬可夫以及貝式機率的應用，對於本研究未來的延伸研究有相當多的建議。

三、建議

與會者多為台灣與大陸學者，由於為 ICIS 的 Pre-workshop，因此與會者多是針對特定議題有興趣來參與。因此未來可針對 main conference 進行投稿，可獲得更多國際學者的寶貴建議。

四、攜回資料名稱及內容

提袋、議程以及光碟。

國科會補助計畫衍生研發成果推廣資料表

日期:2011/09/04

國科會補助計畫	計畫名稱: 建構E化服務之顧客價值衡量模式研究
	計畫主持人: 張瑋倫
	計畫編號: 99-2410-H-032-046- 學門領域: 資訊管理

無研發成果推廣資料

99 年度專題研究計畫研究成果彙整表

計畫主持人：張瑋倫	計畫編號：99-2410-H-032-046-
計畫名稱：建構 E 化服務之顧客價值衡量模式研究	

成果項目			量化			單位	備註（質化說明：如數個計畫共同成果、成果列為該期刊之封面故事...等）
			實際已達成數（被接受或已發表）	預期總達成數(含實際已達成數)	本計畫實際貢獻百分比		
國內	論文著作	期刊論文	0	0	100%	篇	
		研究報告/技術報告	0	0	100%		
		研討會論文	0	0	100%		
		專書	0	0	100%		
	專利	申請中件數	0	0	100%	件	
		已獲得件數	0	0	100%		
	技術移轉	件數	0	0	100%	件	
		權利金	0	0	100%	千元	
	參與計畫人力（本國籍）	碩士生	6	3	100%	人次	
		博士生	0	0	100%		
		博士後研究員	0	0	100%		
		專任助理	0	0	100%		
國外	論文著作	期刊論文	1	1	100%	篇	
		研究報告/技術報告	0	0	100%		
		研討會論文	1	1	100%		
		專書	0	0	100%	章/本	
	專利	申請中件數	0	0	100%	件	
		已獲得件數	0	0	100%		
	技術移轉	件數	0	0	100%	件	
		權利金	0	0	100%	千元	
	參與計畫人力（外國籍）	碩士生	0	0	100%	人次	
		博士生	0	0	100%		
		博士後研究員	0	0	100%		
		專任助理	0	0	100%		

其他成果 (無法以量化表達之成果如辦理學術活動、獲得獎項、重要國際合作、研究成果國際影響力及其他協助產業技術發展之具體效益事項等，請以文字敘述填列。)	無

	成果項目	量化	名稱或內容性質簡述
科教處計畫加填項目	測驗工具(含質性與量性)	0	
	課程/模組	0	
	電腦及網路系統或工具	0	
	教材	0	
	舉辦之活動/競賽	0	
	研討會/工作坊	0	
	電子報、網站	0	
	計畫成果推廣之參與（閱聽）人數	0	

國科會補助專題研究計畫成果報告自評表

請就研究內容與原計畫相符程度、達成預期目標情況、研究成果之學術或應用價值（簡要敘述成果所代表之意義、價值、影響或進一步發展之可能性）、是否適合在學術期刊發表或申請專利、主要發現或其他有關價值等，作一綜合評估。

1. 請就研究內容與原計畫相符程度、達成預期目標情況作一綜合評估

■達成目標

□未達成目標（請說明，以 100 字為限）

□實驗失敗

□因故實驗中斷

□其他原因

說明：

2. 研究成果在學術期刊發表或申請專利等情形：

論文：■已發表 □未發表之文稿 □撰寫中 □無

專利：□已獲得 □申請中 ■無

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本研究以顧客關係管理角度探討電子化服務中顧客價值, 參考過去顧客終身價值的概念, 提出不同以往的計算方式, 除了能夠提供企業不同的觀點外, 亦期望能夠在服務科學領域中提供後續研究基礎. 本研究之研究結果亦能夠結合電子化服務相關研究, 例如電子化服務訂價或電子化服務推薦等.