行政院國家科學委員會專題研究計畫成果報告

電子商務與 Web，VoiceXML 結合的自然語言客戶訂購服務系統

主持人：蔡銘筬　　國立交通大學資訊管理研究所

電子信箱：mjtsai@cc.nctu.edu.tw

1. Abstract

The web-based application by VoiceXML service on the Internet is gradually accepted for human-machine interaction because it provides the speech-enabled functionality and makes the telephone access a reality. However, it is not cost efficient to build voice only stand-alone web implementation and is more reasonable that voice interfaces should be retrofitted to be compatible or collaborated with the existing HTML or XML based web applications. Therefore, this research considers that the web site construction should be able to incorporate multiple access modes so that human beings can perceive and interact with either visual or speech response simultaneously. Under this principle, our research develops an integration web based Mandarin dialog system which adopts ASR, TTS, VoiceXML browser, and VoIP technologies to create user friendly interfaces for GUI and VUI. The user can use traditional telephone line, cellular phone connection, or even VoIP by personal computer to interact with the VoiceXML server. In the mean time, browse the web content from the Internet and access the same document. The implementation system shows excellent performance and can be easily constructed into banks, tourisms, and e-commerce transactions with VoiceXML for wide accessibility.

Keywords: VoiceXML, ASR, TTS, VoIP

中文摘要

本研究計畫運用 VoiceXML 的規格與技術，實做出一個完整的中文語音對話系統，包含自動語音辨識（ASR，Automatic Speech Recognition）、文字轉語音（TTS，TTS, Text-To-Speech）技術以及整合目前日趨成熟的 VoIP（Voice over IP）網路電話技術，使整個系統能完全與 PSTN 整合。另外，本研究計畫運用所提出以 XML 為架構之 VoiceXML Browser，可讓使用者透過傳統電話、手機或是網際網路，來與本系統做語音查詢與瀏覽網頁之功能。進而突破目前 VoiceXML 只運用在純語音查詢資料或是語音訂單的應用。

因此，本研究提出一種整合電子商務與 VoiceXML 的架構，除了結合 VUI（Voice User Interface）與 GUI（Graphical User Interface）的人機互動式介面特色，更簡化傳統 IVR 的複雜語音程序以及降低購買語音設備之成本，有助於降低客戶服務支援中心之成本，並同時提升客戶滿意度。對於使用者而言，本系統也提供更多存取管道，並藉由互動式的語音介面傳遞資訊給使用端。因此，相較於按鍵式服務，語音介面將更易於使用，此應用將適用於銀行、股票報價與交易之客戶服務系統。透過語音自動化服務，並藉由此自然且直覺式的使用者介面來提供更廣泛的存取機制與功能，亦相對提升語音應用程式的應用價值。

關鍵詞：語音標記語言、自動語音辨識、文字轉語音、網路電話

Figure 1. Logical web-based Mandarin dialog system
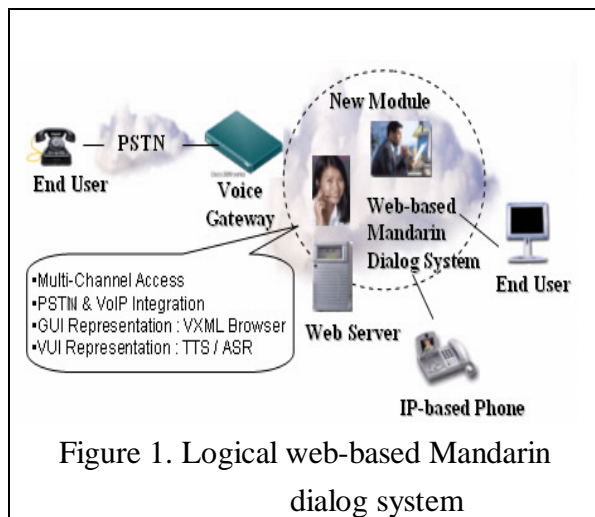
2. Introduction and Motivation

VoiceXML is a XML-based Internet markup language and can be applied to the speech interface that enables telephone access to the PSTN, Internet, or website contents. Users access VoiceXML by dialing the phone number of the application. From the usage point of view, this phone number is similar to the Uniform Resource Locator (URL) of the website. In summary, VoiceXML applications provide another end-to-end telephone system solution for call centers.

The major encouragement of VoiceXML development has been the hope of the telephony industry to make existing telephone networks an essential component in the Information Age. However, using dial-up connection to access the Internet is restricted by the slow speed and instable connection quality. Although broadband connection is developing, it's not mature enough to replace the existing, well-dependent, and highly-tuned capabilities of Plain Old Telephone Service (POTS) [1].

To sum up, VoiceXML consolidates the energy of the Internet with the ubiquity of the telephone, making it possible for businesses to replace the expensive, and proprietary IVR (Interactive Voice Retrieval) platforms with a unified architecture for delivering automated service from any telecommunication device. From the cost reduction point of view, VoiceXML applications have acquired great acceptance from most of the voice call centers (e.g., Tellme Networks, INC.) and many big corporations to improve customer relationship management (e.g., AT&T Corporation, Amazon.com).

In this research, we utilize the VoiceXML properties and capabilities which integrate voice recognition and synthesis technologies with markup languages. In addition, we also incorporate voice and graphical interfaces into current web architectures.

3. Objectives

We establish our major objectives of the research as the following.
(1) Deploy the end-to-end solution to combine the VUI and GUI types.
(2) Deploy the new dialog system that integrates traditional telephony system and VoiceXML communication system.
(3) Deploy the integration platform to merge VoiceXML browser with VoIP （Voice over IP）technologies.
(4) Deploy the integration interfaces to merge VoiceXML browser with traditional web browser.
(5) Deploy the VoiceXML Parser and whatever it does should conform to the VoiceXML 2.0 Specification by W3C definition.

4. The System

As we have discussed, we can find out that the current end-to-end VoiceXML system architecture has some problems. First, the existing VoiceXML system just has VUI representations; it is not suitable for users to use unless it provides GUI representations. Second, it just supplies one-way to access the VoiceXML application through PSTN. It will be more convenient if end users (e.g., callers or pc-based users) can access to VoiceXML application in bi-directional ways through PSTN or Internet. The Figure 1 shows our logical web-based Mandarin dialog system prototype. The system we proposed is platform independent. The key components
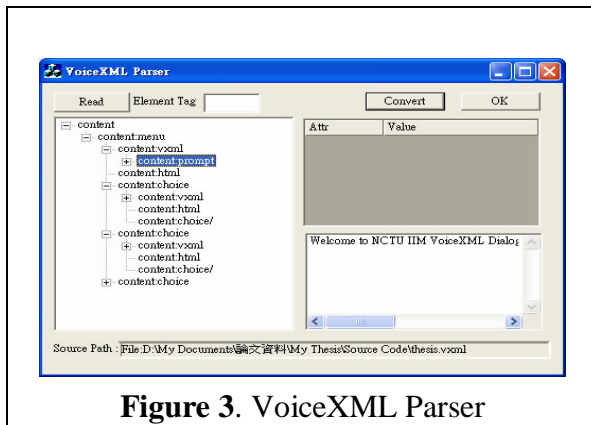
Figure 3. VoiceXML Parser

involve the speech recognition (ASR), speech synthesis (TTS), VoiceXML Browser, VoiceXML Parser, and Voice over IP (VoIP) internet phone[2] [3].

There are two major parts of the whole Web-based dialog system: The VoiceXML Browser and VoIP internet phone. The VoiceXML Browser serves as the traditional IE/Netscape browser and supports VoiceXML-format files to be used in the browser. VoIP internet phone adopts virtual phone appearances in the left side of Figure 2. VoIP internet phone provides basic VoIP functions such that users can call the other user with the mobile phone or PSTN phone. Besides, there are TTS、ASR、VoiceXML Parser and XSL model in the VoiceXML application. We will explain each component in details.

The VoiceXML browser needs to parse vxml pages. The vxml pages are XML documents essentially. We use the Microsoft XML core service software － MSXML 4.0 SP1 to offer a number of new features and improvements over the MSXML 3.0, including the support for the XML Schema language and faster parser and XSLT engine[4] substantially. Finally, we develop our own VoiceXML parser by MSXML 4.0 DOM technology. This mode gives a tree like data-structure for the document in the Figure 3. The Figure 3 shows the usage of the code to read in an existing file and display the hierarchy in a tree with the attributes in the other pane. The VoiceXML parser is used to parse a VoiceXML document. After parsing the document, it retrieves the forms and fields content from the document. Our VoiceXML Parser supports reading or writing VoiceXML and none validated XML files. Although it is very similar to the DOM centric class, each element it provides may be used alone. The specific function provides the programmer a great deal of flexibility in this work.

The prototype of the Web-Based Mandarin Dialog System demonstrates an approach in which the static content is written in a content markup dialogue. It will be transformed into either HTML or VXML. The advantage of using this approach is that the static content is stored in one source file which improves maintainability. In addition, each of these contains various attributes and sub elements that capture all the information needed to generate HTML or VXML. So the root element also contains the elements <html> and <vxml> tag.

The Figure 4 shows while the Web-Based Mandarin Dialog System functions, there is one XSL stylesheet that transforms any document into HTML format. In the other hand, there is another stylesheet that transforms to VXML file. In our prototype, the system will transform a file into a HTML file while the original file

(a) the greeting page   (b) the main food menu   (c) the transaction ending page
Figure 2. VoiceXML Mandarin Dialog System－McDonald's fast food ordering example

contains a sequence of anchors (<A HREF=…>element) in the choice menu source code. Otherwise, the system will output as a VXML file while it contains the VXML form with <choice> element. We use different presentation rules to express the HTML, and VXML file. The <content:html> element captures more verbose text for GUIs and transforms to the HTML file. In the other hand, the <content:vxml> element captures voice or speech behaviors to the VXML file.

While we start the VoiceXML Dialog System, it will display the fast food ordering menu as the example shown in the Figure 2. As shown in Figure 2(a), whenever the user makes the connection to the system, he can simply enter the McDonald's website by pronouncing the correct keyword, for example: McDonald's, or enter. Then vxml pages will open the corresponding corporation main food ordering menu as shown in Figure 2(b). The system will display all the information including commodities items and price through vxml pages of the web browser at the user's browser. For example, in the McDonald's food ordering system, it offers four choices: Big Mac hamburger, Mac chicken hamburger

, apple pie or ice cream. Customers can speak the specific keyword to buy what they need. After Ordering the item and filling the selection or through dialog by VoiceXML, the system will summarize the purchase order and the whole voice dialog transaction follows in a similar way as mentioned above. Figure 2(c) illustrates a successful transaction with a user's ordering information. Finally, the user can exit the dialog system.

5. Discussion

We use the Pentium 733 desktop computer, 512 RAM, high quality microphone / speaker, and Windows 2000 operation system as our performance evaluation environment. The recognition and synthesis of the speech both work on the ASR and TTS machine. We also invited ten persons to test our dialog system for the
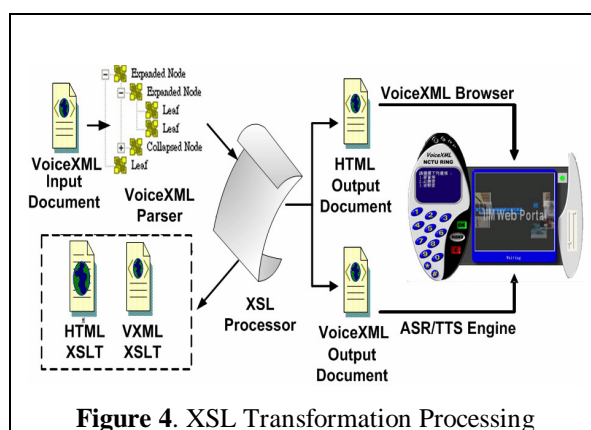

Figure 4. XSL Transformation Processing

experiment samples. Half of the experiment samples are veterans that have been trained how to operate or control the dialog system. The others are novices at our VoiceXML Mandarin dialog system.

There are three fast food restaurants including McDonald's [5], Pizza Hut [6], and Yoshinoya [7] to be chosen in our experiment. In the mean time, we design our system performance analysis table and the testing items with pre-defined keywords. As Table 1 shows, we divide three fast food restaurants ordering subsystems into three tasks in our system performance evaluation.

As Figure 5(a) shows, the result indicates the novices have sometimes speech recognition errors which are caused by ambiguous input keywords or unfamiliarity with the dialog system. On the other hand, the result indicates the veterans always have good speech recognition in the Figure 5(b). Therefore, the consumers or users are better to be pre-trained to understand how to interact with the VoiceXML Mandarin dialog system even though it has better user interfaces.

6. Conclusion

In this research, we deploy the web-based Mandarin dialogue system through the VoiceXML. The user can either use the telephone channels or VoIP by personal computer to access the voice server, simultaneously browse the information on the web server or enterprise database through the Internet. This approach provides multi access mode of directory management scheme for customer service or business management.

Table 1 System Performance Analysis Table

| Task-1 McDonald's		How many the numbers of times to finish the transactions ?
Keywords No.	Keywords	How many times to recognize successful ?
1	McDonald's	
2	Big Mac Hamburger	
3	Mac Chicken Hamburger	
4	Apple Pie	
5	Ice Cream	
Task-2 Pizza Hut		How many the numbers of times to finish the transactions ?
6	Pizza Hut	
7	Fresh Seafood	
8	Super Supreme	
9	Hawaiian	
10	Japanese	
Task-3 Yoshinoya		How many the numbers of times to finish the transactions ?
11	Yoshinoya	
12	Beef Meal	
13	Chicken Meal	
14	Beef & Chicken	
15	Main Menu	
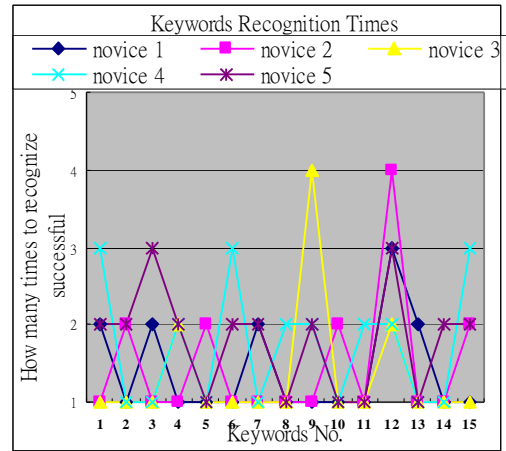
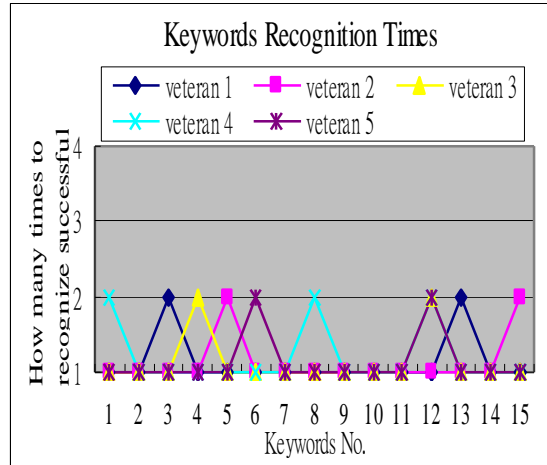**Figure 5(a).** The Novices Keywords Recognition Times Analysis

Figure 5(b). The Veterans Keywords Recognition Times Analysis

The prototype system showed excellent performance from the experiments and can be easily constructed into a large distributed telephone-based database and voice service provider (VSP) for widely accessibility. The techniques and methodology we developed in this research can be applied to many other applications by taking the advantages of the friendly speech interface and the use of our mother language, the Mandarin, to significantly improve the human machine interaction and communication.

七、結果與討論

　　本研究計劃已獲得相當豐富的研究成果，由於前一年相關計畫的前導，再加上這一年孜孜不倦的努力，在本年內，已有數篇英文會議論文的發表。

　　第一篇英文會議論文是發表在ACME，於民國 92 年 7 月 31 日至 8 月 2 日在美國華盛頓州西雅圖市舉行，論文題目是"The Study of Creating Synergy By Applying E-Commerce Strategy in Multi-level Marking"，內容請見[8]及附件一。

　　第二篇英文會議論文是發表在 ACME，於民國 92 年 7 月 31 日至 8 月 2 日在美國華盛頓州西雅圖市舉行，論文題目是"THE INVESTIGATION of CRITICAL FACTORS of E-LEARNING SYSTEM for E-BUSINESS"，內容請見[9]及附件二。

八、計劃成果自評

　　本研究計劃研究成果，已獲得相當具體及深入的學術成果，並提供電子商務的實際應用與 mobile-commerce 可延續性的研究；在此同時，將繼續做更深入的探討外，也努力參與相關學術研討及論文發表，以達更專精的學術研究為目的。

九、參考文獻

[1] Rick Beasley, Mike Farley, John O'Reilly, Leon Squire, "Voice Application Development with VoiceXML", SAMS, 2001, pp. 10-30.

[2] Min-Jen Tsai, Tien-Hwa Ho, "WWW and Telecommunication Collaboration Service for Mandarin Automatic Personal Phonebook Inquire Dialogue System", ICME 2000 conference in New York, USA, 2000.

[3] "IBM WebSphere Voice Server with ViaVoice Technology Administrator's Guide, Version 1.0", IBM Corporation.

[4] MSDN XML Core, http://msdn.microsoft.com/xml

[5] McDonald's Corporation., http://www.mcdonalds.com/

[6] YOSHINOYA D&C Co., Ltd., http://www.yoshinoya-dc.com/n_top.html

[7] Pizza Hut Co., Ltd., http://www.pizzahut.com.tw

[8] Min-Jen Tsai and Shang-Chun Wang, "The Study of Creating Synergy By Applying E-Commerce Strategy in Multi-level Marking", ACME, Seattle, U.S.A. July 31-August 2, 2003.

[9] Tzu-Hsin Yang and Min-Jen Tsai, "THE INVESTIGATION of CRITICAL FACTORS of E-LEARNING SYSTEM for E-BUSINESS", ACME, Seattle, U.S.A. July 31-August 2, 2003.

附件一

The Study of Creating Synergy By Applying E-Commerce Strategy in Multi-level Marking

Min-Jen Tsai and Shang-Chun Wang
Institute of Information Management
National Chiao-Tung University,
1001 Ta Hsueh Rd., Hsin-Chu, Taiwan 300, R.O.C.
Tel : 886-3-571-2121 ext 57406

Abstract: The core of the business in the 21st century can be categorized as e-commerce, chain store, wholesales and multi-level marketing. Among those business models, there are many similarities between e-commerce and multi-level marketing in terms of the essential property of networking in business communication. The goal of this study is to find the similarities between these two business models and discuss the synergy can be created by combining these two business strategies. In this research, we simulated these two-business models at the Yahoo Auction site in Taiwan and the results of click counts and successful trade transactions rate were recorded for analysis. Besides, the investigation and interviews of some direct selling companies are also performed in order to understand how the e-commerce strategies can be implemented in this industry. Therefore, the optimal condition can be derived from both approaches and the better suggestion and well satisfactory return can be provided in the conclusion.

I. INTRODUCTION

The core of the 21st century business can be categorized as e-commerce; chain store; wholesales and multi level marketing. There are so many similarities between e-commerce and multi-level marketing; one of the essential properties is networking. How to build an efficient networking and make it work expandable will be the key for success of these two industries.

The concept of e-commerce is basically about using the Internet to do business. Traditionally, business communication is face to face. Multi-level marketing has advantage of human intervention and just to compromise the weakness of e-commerce since there is no direct human middleman in between. Therefore, if two of them can integrate each other, the synergy can be created.

This research has two objectives:

(1) Create synergy by combining e-commerce and multi-level marketing business strategies.

(2) Provide a better solution for individual direct selling distributors as well as the companies.

II. MULTILEVEL MARKETING

Direct selling is a dynamic, vibrant, rapidly expanding channel of distribution for the marketing of products and services directly to consumers. An essential component of the direct selling industry is multi-level marketing. It is also referred to as network marketing, structure marketing or multi-level direct selling, and has proven over many years to be a highly successful and effective method of compensating direct sellers for the marketing and distribution of products and services directly to consumers. [1] Direct selling should not be confused with terms such as direct marketing or distance selling which may be described as an interactive system of marketing that uses one or more advertising media to affect a measurable response and transaction at any location. Some commonly known types of direct marketing and distance selling techniques are telemarketing, direct mail, and direct response.

Although direct selling organizations occasionally use some direct marketing or distance selling techniques and technology to enhance their businesses, the primary difference between the two methods of marketing is the face-to-face, or personal presentation that is always an aspect of the direct selling relationship. [1] In addition, any enterprise engaged in multi-level sales is required to register with the Fair Trade Commission (FTC) according to the "Supervisory Regulations for Multi-level Sales." As shown in Table 2.1 is the statistic of registered enterprises by end of current year in Taiwan. We could see the numbers of companies are almost stable after year 2000.
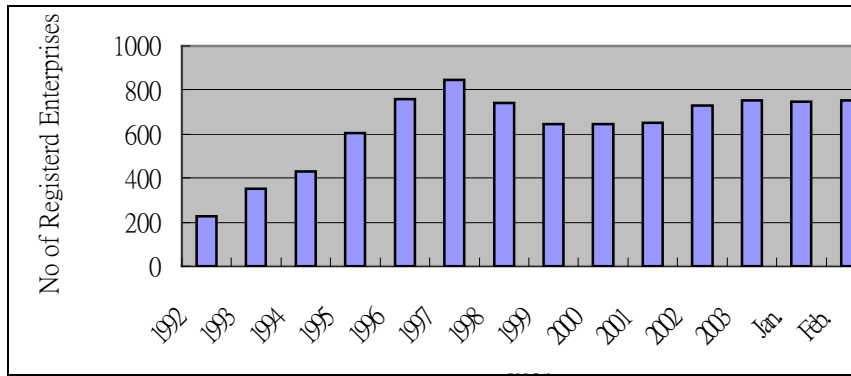
Table 2.1 Statistic of registered Enterprises by end of current year
(Source from FTC Taiwan 2003)

III. POWER OF MULTIPLICATION

One of the successful business strategies for the multi-level marketing is well applying the power of multiplication. One of the practical examples, "Pay it forward" story has been selected to show the power of multiplication and how the network can be developed infinitely.

The "Pay it forward" story: A schoolteacher in a small California town gives his class an extra-credit project: Come up with an idea that can change the world. A boy named Trevor devises a "chain letter" of deeds: One person does a nice thing for, say, three people, with the proviso that they pay it forward, not back -- that is, those three each have to do a nice thing for three other people, those nine each do something nice for another three apiece, and so forth. The geometrical implications are obvious; at the 16th level, about 43 million people are suddenly basking in random acts of kindness. [2]

Figure 3.1 Structure of Pay it forward foundation

The Pay it forward movement is the real-life reaction to the release of the novel in early 2000, followed by the creation of the Pay It Forward Foundation. The structure of Pay it forward foundation is shown in Figure3.1. Catherine Ryan Hyde didn't write the novel expecting a social movement, but it's certainly been exciting to watch it grow. The purpose of the Pay it forward Movement website is to bring together, in one place, as many real stories as we can. This serves several purposes. It helps the cynics see that Pay it forward really is working, not just around the United States but also around the world. It brings much-deserved recognition to those doing the work, and puts the results of their efforts out in the open so others can be inspired. It's also a source of some good news for a change, a way to renew your faith in human nature. [3]

I.V. E-COMMERCE

The term commerce refers to all the activities in which a company or individual engages to complete a transaction. When you use the Internet to engage in some or all of these activities, commerce becomes e-commerce. Therefore, you can define e-commerce as using the Internet to assist in the trading of goods and services. Other terms that refer to doing business over the Internet include e-business, e-tailing, and e-trading. [4].

According to Institute for Information Industry ROC, by the end of September 2002, there are more than 8.35 million people online and the network facilities are 37% average provided. As shown in Figure 4.1 the usage statistics are still increasing 1.3 times each year. The Figure 4.2 shows the top six portal website in Taiwan which was surveyed by Netvalue 2002. Currently, Yahoo is the most popular portal site in Taiwan.
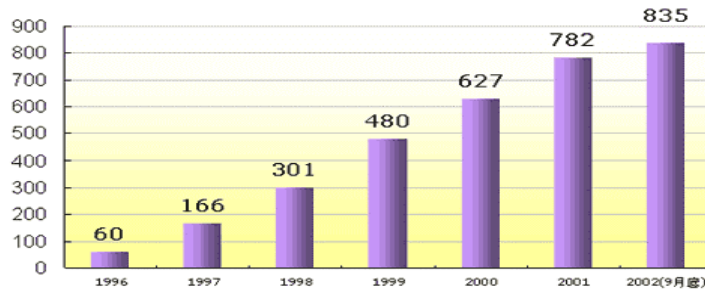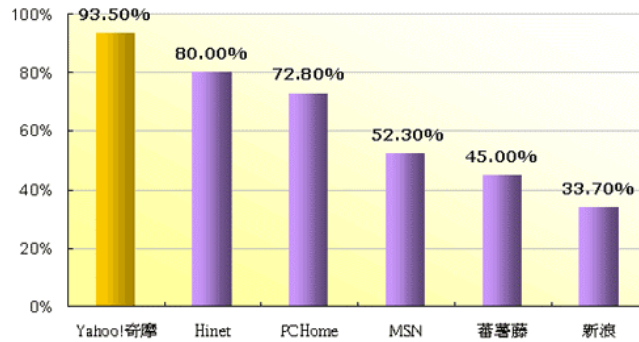
Figure 4.1.Taiwan Internet usage

Figure 4.2.Top 6 portal website in Taiwan

In this research, the simulation of e-commerce and multi-level business models on the Internet was choosing Yahoo Auction site as the reasons base on the following:

● Most Internet market coverage

As shown in Figure 4.3, Yahoo website has the most Internet market coverage from the study of Netvalue in 2002.

● More than 100 Million Auction products

Yahoo Auction site has exceeded more than 100 million auction products on site and Yahoo has promoted the website via media.

● Cost consideration

Commonly, if you want to build a business website, you have to pay the rental fee for the platform and register your domain name as well as the maintenance fees to be able to start your own e-business. So far, Yahoo Auction site provides free services for the sellers.

Figure4.3. Portal website Internet market coverage in Taiwan

V. RESEARCH METHOD

This research phases were divided into three parts, the first part is to interview with four different senior direct selling distributors from four different industries. The discussions are based on the topic of "the vision for e-commerce regarding their enterprises". The second part involves using questionnaire of the top 30 premium sellers from Yahoo Auction site and the third part provides the simulation of those two-business models on the Internet via Yahoo Auction site, an online auction platform. The results of click counts and successful trade transactions rate are recorded in details. This simulation focuses on the difference between trades only on e-commerce site and how the synergy can be created by apply Multilevel marketing strategy on e-commerce site.

The author has registered two different accounts from Yahoo Auction site to be able to collect the real on-site data and experiences. These two auction accounts are designed under similar conditions including price, product, promotion, and auction period. The only exception is that Account B has applied the multi-level marketing strategy, which includes usage of personal network and the participation of direct selling distributors. Account A is represented for the usage of the e-commerce only which shows in Figure 5.1 and Account B is represented for applying network marketing strategies on e-commerce which shows in Figure 5.2. This research would like to compare with the click count rate and successful trade transaction rate under these two accounts.

However this research has limitation on the variety of products. We only provide some generality consumer products, which include facial masks, essential oils and aroma products to sell on site. Therefore the limited product range will affect the experimental result.

Figure 5.1. Account A

Figure 5.2. Account B

V.I. RESULTS

Result One

　　According to the interviews with four different industries senior direct selling distributors, several discussions are held on the topics of "the e-commerce visions about their enterprises" The four industries are cover cosmetics products; aroma products; health products and travel services provider companies. The interview results are summarized as follows:

1. Most of the direct selling companies do provide the home website for their distributors, but the website only functions as information channel to them.
2. Although those companies think positively about the outcome of e-commerce, neither companies nor individual distributors feel confident to invest in e-commerce now.
3. Some of the companies believe when they have extensive volume of members under their network, it will be easier for them to attract the e-commerce suppliers to corporate with them.
4. The Internet usages for direct selling distributors are increasing daily. Therefore e-commerce should be the fortune for them.

Result Two

　　The researcher has selected 30 premium sellers out of 14 products categories from Yahoo Auction site. They are all qualified as the premium sellers and do receive medals from Yahoo auction site, which has shown in Figure 6.1. When the seller 's reputation and success trading transactions are on the top range of each category, Yahoo will rate the most praised premium sellers out of 14 products categories. [5].
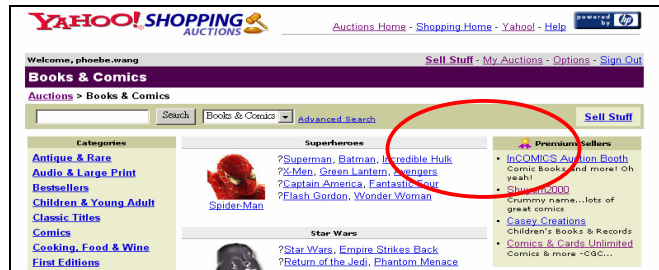
Figure 6.1. Example of a premium seller medal

From the survey of the top 30 premium sellers from Yahoo Auction Site, there are only 20 questionnaires replied. The results have been summarized in the followings with figures 6.2-6.5.

● Time period

To be able to qualify as a premium seller, trading period is one of the factors to be considered. We can see from the Figure 6.2, most selected premium sellers are trading under Yahoo Auction at least six months and above.

● Working hours

A good service provider is also one of the key factors for the success of e-commerce. To be able to response the questions from the buyers, 75% of the premium seller spend more than 7 hours on the auction site as shown in Figure 6.3.

● Personal network

From Figure 6.4, 62% of the premium sellers do apply their personal network to advertise their auction site. The result has once again shown that the personal networking does increase the volume of selling of their products.

● Return customer base

The distributors of multilevel marketing are normally the royal customers for the company. Therefore how to remain the return customer base is very important. From Figure 6.5, there are 13 of premium sellers state that 10%-30% customers will return buying goods from them.
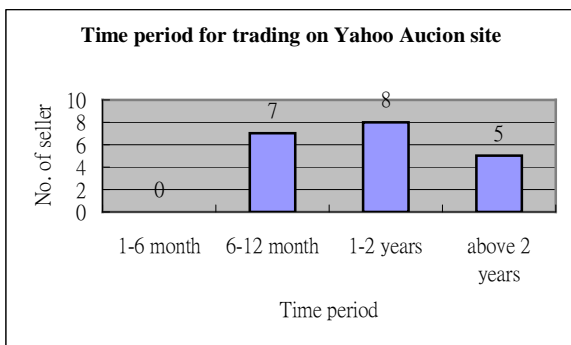

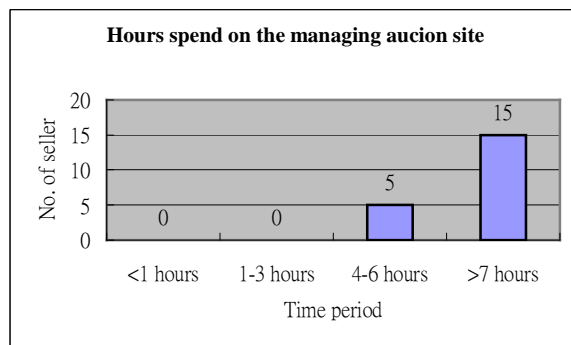**Figure 6.2.Time period for trading on Yahoo Auction Site**

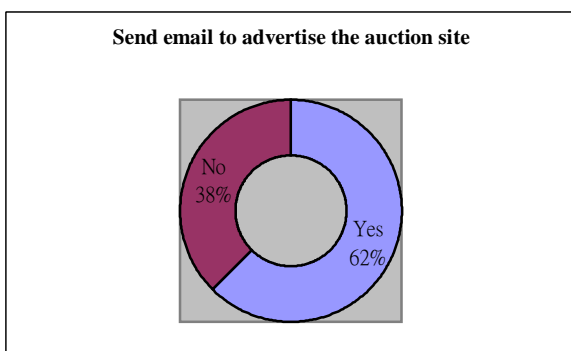**Figure 6.3.Hours spend on the managing auction site per day**

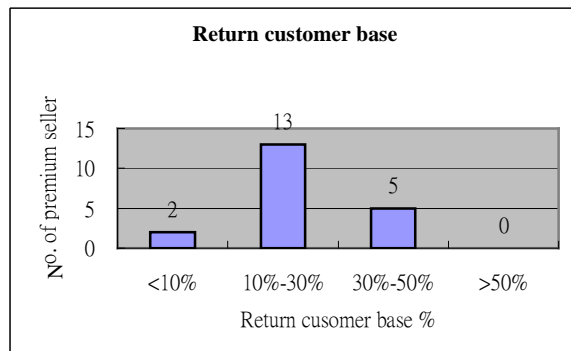**Figure 6.4 Usage of personal network to advertise**

Figure 6.5 Return customer base ratio

the auction site

Result Three

Each experimental test has been set as five days per cycle under Yahoo Auction site. After 15 times run of each 5 days cycle test, we can see the click counter statistic summary records as well as the successful trade transaction statistic records from Figure 6.6 and Figure 6.7 respectively.

The results show that the average click counts of Account A are 8.8 times per cycle and 31.8 times per cycle for Account B. From the above statistical results Account B has 3.6 times more click counts than Account A. As from the successful trade transaction rate, the average rate for Account A is 0.2 times per cycle after 15 test cycles and 1.6 times for Account B. The successful trade transaction rate of Account B is 8 times higher than Account A.

By analyzing the Figure 6.6 in details, we can see that the results remain stable during test cycle number 9 to number 11. One of the reasons is Yahoo has updating his searching method during that phase. Yahoo Auction site starts to charge the sellers if the sellers would like to make their products conspicuous to the auction buyers. Therefore the chance for your auction item to be viewed or searched by the buyers is not high. And the other macroeconomic factors, which could affect the results, are not taking into concern in this experiment. The research is focused in the results of variation between two accounts.

From the experience of selling the products under Yahoo Auction site, which contains more than one million product items under auction site, we can see that Account B has higher click count rate and successful trade transaction rate than Account A. According to the results that we can say the objective of this research has been achieved as combining e-commerce and Multilevel Marketing these two business strategies can create the synergy
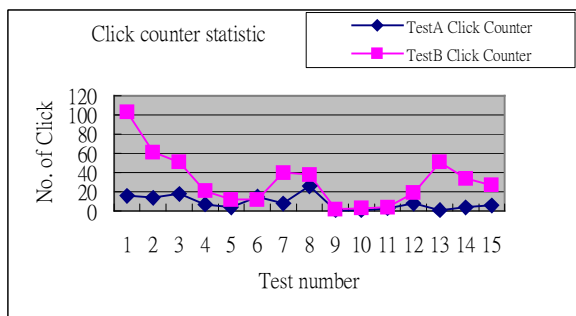

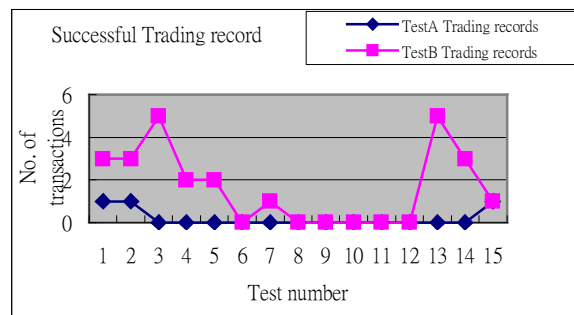**Fig6.6 Click counters statistic records**

Figure 6.7 Successful trade transaction statistic records

CONCLUSIONS

This paper has proposed that the synergy can be created by applying e commerce in multilevel marketing, and has summarized the results of interviewing with different senior direct selling distributors; survey questionnaires of top 30 premium sellers from Yahoo auction site and described the experimental results as simulated on Yahoo Auction site. The results of experiments in a real environment have suggested that

1. The trust relationship between buyer and seller will be the key for the success trading online. Therefore if the buyer knows who the seller is, they will feel more secure and relaxed to trade online.
2. As a direct selling distributor, trading online will expand the business area and meet more potential customers.
3. Return customer details should be recorded and analyzed. Providing the good service to your core customer will maintain your business volume.
4. Everyone has personal relationship network. Whenever they support your business, you can save a lots of money on the advertisement cost.
5. To trade online and managing an e-shop needs lots of the efforts. The volume of the successful trading transaction is proportional to the time spent on the e-commerce.
6. As for the direct selling distributors, they should accept the trend toward the e-commerce instead of against it, as e-commerce should increase the business territory for them.

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REFERENCES

[1] http://www.dsa.org. (World Federation of Direct Selling Associations, WFDSA)
[2] http://payitforward.kingnet.com.tw/index.html
[3] http://www.payitforwardfoundation.org/
[4] Carol M, Cram, *E-Commerce Concepts,* Course Technology, 2001
[5]http://tw.bid.yahoo.com/phtml/auc/tw/premiumsellers/learnmore.html
[6] http://taiwan.cnet.com/
[7] http://www.cw.com.tw/

[8] http://www.ftc.gov.tw/mult.htm
[9] http://www.moea.gov.tw/~doc/ce/cesc1000.html

THE INVESTIGATION of CRITICAL FACTORS of E-LEARNING SYSTEM for E-BUSINESS

Tzu-Hsin Yang and Min-Jen Tsai,
Institute of Information Management
National Chiao-Tung   University,
1001 Ta Hsueh Rd., Hsin-Chu, Taiwan 300, R.O.C.
Tel : 886-3-571-2121 ext 57406

Abstract: This study investigates five critical factors of the e-Learning system for e-Business. The factors of interest have been categorized as "four barriers to an e-Learning system for e-Business", "reasons to implement an e-Learning system for e-Business", "vendor consideration", "success factors" and "challenge factors". This survey is conducted to examine the attitudes toward these five factors and provide intensive analysis in this study. Acceptance and rejection rates of each factor are calculated and compared. Most of the factors proposed in this study are proven to be acceptable by the participants. Especially "success factors" (94%) and "challenge factors" (93%) accumulate significant acceptance rates, followed by "vendor consideration" (90%) and   "reasons for implementation" (89%) which also get high acceptance rates. Lastly, "four barriers" (79%) receives the lowest acceptance rate which means the participants do not think these four barriers to be crucial for the implementation. When taking neutral rate into consideration, we find that "cost too high" (34%) , "solution immaturity" (27%) , "reduce training cost (27%), "increase revenue" (30%), "decrease time spending on selling" (35%), "win-win situation with vendors" (27%),   "enhance customer satisfaction" (32%) and "fame" (35%) are all around 30%. Approximately one thirds of the participants do not have specific ideas toward all these sub-factors.

Keywords: e-Learning, e-Business, barrier, reason, vendor consideration, success factor, challenge factor

INTRODUCTION

E-Learning is leading a novel way of learning. It enables learning in a more flexible way. Learners can access e-Learning websites, post their feelings and questions, or take learning courses anytime and anywhere. It provides a more effective interface than conventional classroom training which supports the education portions of corporate e-Business practices. B2B e-Learning systems facilitate enterprise inside and outside (i.e. business-to-business) learning mechanisms via the Internet. For example, CISCO, IBM and Microsoft utilize innovative learning technologies and implement their e-Learning systems into e-Business. Therefore, their employees, business partners and customers are capable of accessing the e-Learning portals from any part of the world. However, some other B2C online e-Learning course providers such as Pospo and Englishtown that provide on-line fee-based training courses especially for anyone who can access their e-Learning portals. This study emphasizes the former – the critical factors of B2B e-Learning systems.

This report includes analyzing data that are collected from the survey for "critical factors of an e-Learning system for e-Business", and hopefully it provides some practical advices for those who are just getting started. Although e-Learning is getting more popular, a few research reports investigation on its critical factors. Why do corporations need to understand all these critical factors clearly? Because by doing so, corporations can save time and avoid money spending in the wrong ways. This survey is based on the previous research of "How to Setup a Successful E-Learning System for E-Business", which is published in ICEB2002. This survey intends to measure the acceptance, neutral and rejection rate toward the critical factors proposed in the previous study and extract valuable findings inside the results.

EXPLANATION OF FACTORS

There   are   five   main   factors   under   investigation. They   are   "barriers to an e-Learning system for e-Business", "reasons to implement an e-Learning system for e-Business",   "vendor consideration", "success factors" and "challenge factors". Each factor contains sub-factors. "Barriers to an e-Learning system for e-Business" consists of four sub-factors. "Reasons to implement an e-Learning system for e-Business" consists of twelve reasons, which are the viewpoints of eight stakeholders from my previous research, i.e. CEO, HR, IT, financial, sales departments, employees, vendors and customers. "Vendor consideration" contains six sub-factors. Lastly, "success" and "challenge" factors have eight sub-factors. In order to have a precise understanding of all the critical factors under investigation, this section describes them in details.

Factors of Barriers

Classroom training is not the only choice. Instructors and students can have training courses via the Internet. E-Learning changes the format of learning for e-Business. However, not every corporation implements an e-Learning system for e-Business. There are barriers needed to be overcome before implementation [10].   The first barrier is "cost too high". There are very few successful e-Learning implementation cases, thus corporations are not willing to spend too much money on it. The second barrier is "technology immaturity". The average life cycle is too short to motivate corporations to adopt them. The third barrier is the "solution immaturity". A few vendors finish developing complete solutions, and they are still having experiments. The fourth barrier is "unawareness". People are used to traditional training, and it is difficult to accept new training ways.

Factors of Reasons for Implementation

Despite the barriers, different stakeholders have their own reasons for setting up e-Learning systems. CEO views it as a way to increase competence effectiveness and stay innovative. HR department uses it to train employees 24 hours a day, and 7 days a week. IT department builds training infrastructure using new technology. Financial department reduces training costs. Employees improve their skills, earn more money, and avoid dull classes. Salesmen use it to increase sales and improve time proficiency. Vendors sell their products and gain feedbacks from corporations.   Customers receive their education and services online.

Factors of Vendor Consideration

Vendors of content will sell off-the-shelf courseware. They can work with corporate subject matter experts to produce customized courses. Vendors of technology will build the e-Learning system infrastructures and provide related technologies, for example, installation of LMS / LCMS and integration of chat rooms and virtual rooms. Vendors of service will support training tutors, developing a custom portal, integrating back end systems and so forth. The e-Learning implementation experiences will help to improve their solutions to be stable. The fame of vendors will let corporations know them well.

Success Factors

Eight success factors are investigated [1] [3] [9]. The first one is "organizational support". If the e-Learning system will be included in the appraisal and salary review process, it will soon be one important part of employees' daily work. The second one is "virtual project teams". Members from different departments will create the virtual project teams. They will contribute their unique skills, knowledge, or technologies to setup the e-Learning system. The third one is "measures everything". Corporations can find out what strategies and objectives should be included   by measuring every factors needed. The fourth one is "include independent learners". Independent attitudes will help them learn online courses by themselves. The fifth one is "include peer interaction". Peer interaction will give aids to the learners by using message boards, chat rooms, communities and so forth. The sixth one is "provide mentoring". With the help of instructor mentoring, learners can avoid confusing situations on learning topics or processes. The seventh one is "offer performance feedback". An e-Learning system can offer performance feedback to learners immediately. The eighth one is "marketing". A good marketing will facilitate the investment to be adjusted to the directions, which customers need. It will also increase the revenues from profitable customer education.

Challenge Factors

Eight challenge factors are investigated [4]. The first one is "correct target setup". Different stakeholders must decide what business requirements are – workforce, sales channel, customer education and so forth. The second one is "LMS / LCMS configuration". Be aware of how the portal and tracking system are built. It will be helpful to keep a good tracking of the audiences. The third one is "tutors and subject matter experts (SMEs) integration". They will provide good services and helpful courses. The fourth one is "content creation". Despite the user-friendliness, content will impact learners' attitudes toward an e-Learning system. The fifth one is "multiple modes of learning".   An e-Learning system has different learners ranging from CEO, managers, employees, salesmen, to customers; it has to provide a flexible interface. The sixth one is "back-end systems integration". An e-Learning system needs to process many data; some data are from ERP and CRM systems. The seamless integration among them will help the e-Learning system to be more powerful. The seventh one is "web infrastructure". The

system needs to serve many audiences at the same time, it will be important to implement a high-performance web infrastructure. The eighth one is "online lab access". Corporations need to train learners on how to use an e-Learning system.

APPROACH

The survey utilizes one questionnaire which focuses on the critical factors of an e-Learning system for e-Business. Three different formats of questionnaire are offered, and they are web-base, electronic and hardcopy questionnaires. Majority of participants used the web-based questionnaire which seems to the most convenient interface for them. The questionnaire consists of six sections. Section 1 identifies the demographic information of the participants. Questions include their gender, age, career, department, position and education.   Section 2 asks for their views on "four barriers to implement an e-Learning system for e-Business". Section 3 collects their attitudes toward "twelve reasons to implement an e-Learning system for e-Business". Section 4 requests them to rate how much they agree/ disagree with "six factors of e-Learning vendor consideration". Section 5 weights their viewpoints toward "eight e-Learning success factors". Finally, section 6 weights their attitudes toward "eight e-Learning challenge factors".

Factors under Investigation

In this survey, five main factors are discussed. Each of the five main factors contains sub-factors. In order to have a clear image, they are listed below by main factors.

Factors of Four Barriers to Implement an E-Learning System for E-Business
B1   The cost is very high, so it will be cut very often.
B2   The technology is very new, so it will change in a short period of time.
B3   There are many vendors providing e-Learning solutions, but most of them are on their experiments.
B4   Organizations get few ideas of what an e-Learning system will actually benefit them.

Factors of Reasons to Implement an E-Learning System for E-Business
R1   Enhance organizational competence effectiveness.
R2   Keep organizational innovative technology.
R3   Provide 24 x 7 full time training.
R4   Reduce the time spending on conventional training.
R5   Utilize new type of technology to deliver training courses.
R6   Reduce the cost spending on conventional training.
R7   Increase organizational revenue by providing fee-based training courses to customers.
R8   Decrease the time salesmen spending on selling products to customers.
R9   Keep learning flexible.
R10 Corporations can corporate with vendors of e-Learning systems and reach win-win situations.
R11 Provide customers on-line and real-time learning services.
R12 Enhance customers' satisfaction.

Factors of Vendor Consideration
V1   The contents of vendors' e-Learning systems are very important.
V2   The technology integration capabilities of vendors are very important.
V3   The service qualities of vendors are very important.
V4   The implementation experiences of vendors are very important.
V5   The cost of vendors' e-Learning system solutions is very important.
V6   The fame of vendors is very important.

Success Factors
S1   Organizational Support   S2   Virtual Project Teams   S3   Measure everything
S4   Include independent learners   S5   Include peer interaction   S6   Provide mentoring
S7   Offer performance feedback   S8   Marketing

Challenge Factors
C1   Correct target setup   C2   LMS configuration   C3   Tutors and SMEs integration
C4   Content creation   C5   Multiple modes of learning   C6   Back-end systems integration
C7   Web infrastructure   C8   Online access capability training

DATA ANALYSIS

The survey was conducted from May 13 to May 17, 2003. A total of 142 participants, including 56 female and 86 male respectively, agreed to participate in this study. Most of them are from Hsin-Chu Industrial Science Park and National Chiao-Tung University. Their ages range from 20 to 56 years old. The majority of them work in electric, electronics, or information technology industries. The second majority of them are students from schools. They are grouped by departments. Most of them are from management, information technology, technical support, or research and design. When analyzing their positions, many of them are from middle-level executives, low-low executives, or engineers. Lastly, when analyzing their educations, they are mostly well-educated. Table 1 lists the detailed amounts of demographic items.

No	Item	Detailed Amounts of Demographic Items				
1	Gender	86 : Male	56 : Female			
2	Age	4 : 20 and below	35 : 21-25	28 : 26-30	43 : 31-35	18 : 36-40
		8 : 41-45	4 : 46-50	1 : 51-55	1 : 56 and above	
3	Career	42 : Student	23 : Electric and Electronics	33 : Information Technology	2 : Finance	22 : Military, Government and Education
		12 : Manufacturing and Business	2 : Self-Employment	6 : Others		
4	Department	20 : Management	6 : Human Resource	31 : Information Technology	12 : Research and Design	16 : Technical Support
		1 : Finance	5 : Sales	2 : Customer Service	49 : Others	
5	Position	4 : High-Level Executive	17 : Middle-Level Executive	18 : Low-Level Executive	30 : Engineer	14 : Staff
		4 : Technician	55 : Others			
6	Education	3 : High School	15 : Junior College	72 : University	51 : Master	1 : Doctor

Table 1: Demographic Information

Analysis Equations

Before examining the results, we should define some analysis equations, which indicate how agreement, acceptance, rejection, average agreement, average acceptance and average rejection rates are calculated.

$$Agreement\ Rate = Strongly\ Agree\ Rate + Agree\ Rate \qquad (1)$$
$$Acceptance\ Rate = Strongly\ Agree\ Rate + Agree\ Rate + Neutral\ Rate \qquad (2)$$
$$Rejection\ Rate = Disagree\ Rate + Strongly\ Disagree\ Rate \qquad (3)$$
$$Average\ Agreement\ Rate = Total\ Amount\ of\ Strongly\ Agree\ and\ Agree\ Selection\ /\ Total\ Amount\ of\ Selection * 100\% \qquad (4)$$
$$Average\ Acceptance\ Rate = Total\ Amount\ of\ Acceptance\ Selection\ /\ Total\ Amount\ of\ Selection * 100\% \qquad (5)$$
$$Average\ Rejection\ Rate = Total\ Amount\ of\ Rejection\ Selection\ /\ Total\ Amount\ of\ Selection * 100\% \qquad (6)$$

Agreement rate represents the total rate of strongly agree and agree selection. By identifying agreement rate, it is clear that sub-factors are mostly accepted. However, acceptance rate accumulates the total rate of strongly agree, agree and neutral rate. By analyzing acceptance rate, we conclude that sub-factors are mostly accepted. Regarding to rejection rate which represents the total rate of strongly disagree and disagree, the value clearly illustrates which factors are totally rejected without any hesitation.

Analysis Result of Four Barriers

"Solution immaturity" receives the highest acceptance rate, i.e. 84%. "Technology immaturity" and "unawareness" generate 80% acceptance rate. Lastly, "cost too high" only accumulates 71% acceptance rate. We conclude that the participants

emphasize "solution immaturity". "Technology immaturity" and "unawareness" are also significant factors. In comparison with other three barrier factors, "cost" of an e-Learning system is the least important factor. However, when comparing the agreement rates of "solution immaturity" (57%), "technology immaturity" (61%) and of "unawareness" (60%), these values show a slight difference which needs to be further analyzed. Table 2 shows the detailed statistical result of barrier factors.

Code	Factor	Strongly Agree		Agree		Neutral		Disagree		Strongly Disagree	
B0	Four Barriers	TS	PT	TS	PT	TS	PT	TS	PT	TS	PT
B1	Cost too High	7	5%	45	32%	49	34%	34	24%	7	5%
		Acceptance Rate : 71%						Rejection Rate : 29%			
B2	Technology Immaturity	13	9%	74	52%	27	19%	25	18%	3	2%
		Acceptance Rate : 80%						Rejection Rate : 20%			
B3	Solution Immaturity	12	8%	69	49%	38	27%	23	16%	0	0%
		Acceptance Rate : 84%						Rejection Rate : 16%			
B4	Unawareness	13	9%	72	51%	29	20%	28	20%	0	0%
		Acceptance Rate : 80%						Rejection Rate : 20%			
	Total	45	8%	260	46%	143	25%	110	19%	10	2%
	Total Average Rate	Average Acceptance Rate : 79%					Average Rejection Rate : 21%				

ps: TS refers to "Total amount of Selection"; PT refers to "Percentage".

Table 2: Factors of Four Barriers to Implement Statistical Result

Analysis Result of Reasons for Implementation

The acceptance rates of "Support 24 x 7 training", "utilize novel training technology", "win-win situation with vendors" and "provide customer on-line learning" are 94%, thus we can conclude that all these four factors are the key reasons. "Increase competence", "Stay innovative", "reduce training time", "reduce training cost", "provide flexible learning" and "enhance customer satisfaction" play significant roles in reasoning for implementation. In contrast, the acceptance rates of "increase revenue" and "decrease time spending on selling" are low (under 80%). Therefore, detailed statistical results of "factors of reasons for implementation", "factors of vendor consideration", "success factors" and "challenge factors" are omitted.

Analysis Result of Vendor Consideration

"Technology integration" accumulates its acceptance rate of 95%. "Service quality" also gets an acceptance rate of 94%. Therefore, we conclude that these two factors are key factors for vendor consideration. "Content", "implementation experience" and "implementation cost" are significant factors, which get acceptance rates around 90%. Lastly, "Fame" seems to be the least important factor when choosing an e-Learning vendor (82%).

Analysis Result of Success Factors

The most acceptable success factors are "measure everything", "include peer interaction" and "provide mentoring", and their acceptance rates are all around 94%. "Virtual project teams" and "offer performance feedback" are also crucial which rate 93%. "Organizational support", "include independent learners" and "marketing" also rated around 90%. In summary, all the eight success factors weight high and are proven to be significant.

Analysis Result of Challenge Factors

All the challenge factors are highly accepted by the participants which are about 94%. The highest one is "correct target setup" which is 96%. "LMS configuration", "tutors and SMEs integration" and "web infrastructure" are 95%. "Content

creation" and "back-end systems integration" are 94%. Finally, "multiple modes of learning" and "online access capability training" rated 93%. In summary, all the eight challenge factors are proven to be important.

CONCLUSION

All the statistical results in the study provide useful information on how to setup a successful e-Learning system for e-Business. The eight success factors and eight challenge factors give strong evidences of their effectiveness to an e-Learning system. Among the four barriers presented in this study, their average acceptance rate is 79%. It indicates that the participant only regard them as common barriers. Especially, the acceptance rate of "cost too high" is only 71%. It shows most people do not view "cost of an e-Learning system" to be crucial. The average acceptance rate of reason factors is 89%. However, the acceptance rates of "increase revenue" and "decrease time spending on selling" are around 75%. The participants weight these two factors slightly. The average acceptance rate of vendor factors is 90%. The lowest acceptance rate is the fame of vendor (82%). The participants care less about whether the vendors are famous or not. Instead, they emphasize vendors' technology capabilities.

When analyzing the neutral rate of each sub-factors, we can find that "cost too high", "solution immaturity" under "barriers", "reduce training cost", "increase revenue", "decrease time spending on selling", "win-win situation with vendors" and "enhance customer satisfaction" under "reasons for implementation", "fame" under "vendor consideration" are around 30%. About 1/3 of the participants do not have special ideas about these sub-factors. "Technology immaturity", "unawareness" under "barriers", "increase competence", "stay innovative" under "reasons for implementation", "implementation cost" under "vendor consideration", "virtual project teams", "measure everything", "include peer interaction", "marketing" under "success factors" and "back-end systems integration" under "challenge factors" are around 20%. Nearly 1/5 of the participants do not have strong feelings toward these sub-factors.

Clear understanding of these results will help corporations to know where they stand. Therefore, they can setup correct strategies and objectives which will lead them to a smooth implementation of an e-Learning system for e-Business. Vendors of e-Learning can view what end-users emphasize the most about their solutions. Different stakeholders can take a look at different perspectives; therefore understanding of what others feel about a better e-Learning system for e-Business is important. Figure 1 depicts the average acceptance rate of five critical factors.
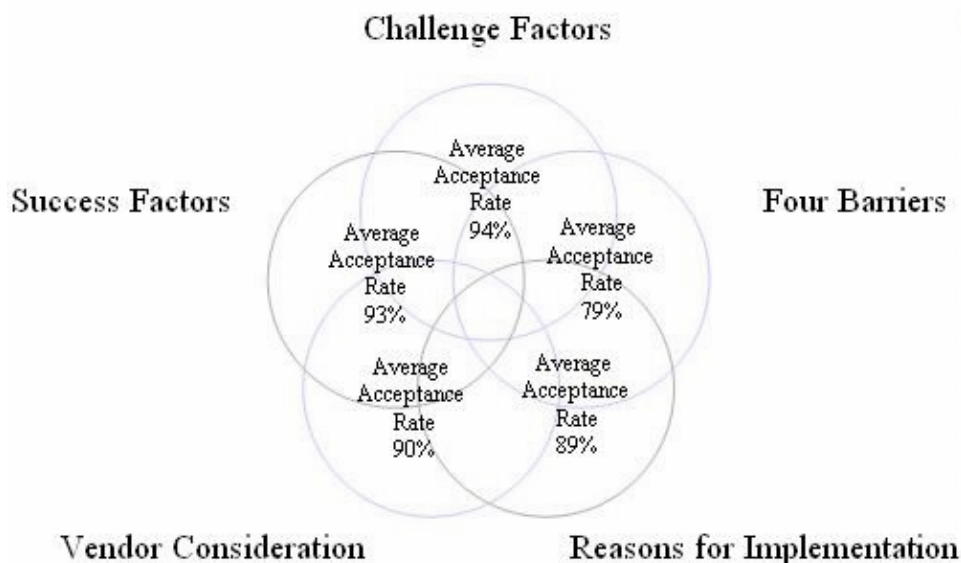

Figure 1: Average Acceptance Rate of Five Critical factors

References

[1] Cisco. *E-Learning Solution Implementation Success Factors*, 2001, http://www.cisco.com/warp/public/10/wwtraining/ elearning/implement/success_factors.html

[2] Darin Hartley. *Bankruptcy-Proof Your E-Learning Project*, December 2001, http://www.learningcircuits.org/2001/dec2001 /hartley.html

[3] David Price and Patrick von Schlag. *Bringing Classroom Curriculum Up to E-Speed*, September 2001, http:// www. learningcircuits.org/2001/sep2001/price.html

[4] Digital Think. *The Corporate E-Learning Solution*, 2000, http://www.infotoday.com/KMWorld2000/presentations/WhitePaper.pdf

[5] Docent, Inc... *Calculating the Return On Your eLearning Investment*, September 2001, http://www.docent.com/elearning/ ROI_01.html

[6] Harvi Singh. *Achieving Interoperability in e-Learning*, March 2000, http://www.learningcircuits.org/mar2000/singh.html

[7] John L. Setaro. *Many Happy Returns: Calculating E-Learning ROI*, June 2001, http://www.learningcircuits.org/2001/jun2001/elearn.html

[8] Marc J. Rosenberg. *E-Learning: strategies for delivering knowledge in the digital age,* McGraw-Hill, 2001, 273-277.

[9] Michael Brennan, Susan Funke and Cushing Anderson. *The Learning Content Management System*, 2001, http://www.internettime.com/itimegroup/lcms/IDCLCMSWhitePaper.pdf

[10] Tom Barron. *Learning Object Approach Is Making Inroads*, May 2002, http://www.learningcircuits.org/2002/may2002/barron.html