

Evaluating Web Site Support Capabilities in Sell-Side B2B Transaction Processes: A Longitudinal Study of Two Industries in New Zealand and Taiwan

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ABSTRACT

Business-to-business (B2B) transactions supported by the World Wide Web (Web) have become a major portion of e-commerce transactions. Despite growth, knowledge of the degree of Web site support capabilities in the B2B transaction process is limited. This paper longitudinally compares how Web sites supported the B2B transaction process in New Zealand and Taiwan between 2001 and 2007. The results indicate that, on average, New Zealand Web sites scored higher than those in Taiwan in both years. Yet, the rate of improvement of Taiwanese Web site scores is significant. Specifically, the support capability of several Web functions, including privacy, company information, financial information and product catalog has improved over the study period. The authors found that the sampled Web sites in New Zealand and Taiwan provide different support capabilities to the activities in the B2B transaction process. Taiwanese Web sites are more concerned with providing after-sale services via the Internet whereas New Zealand Web sites are more concerned with sharing information. These two countries' Web sites share a similar focus on supporting B2B transactions, which provides strong support for users to conduct product promotion and information provision related activities over the Web. Based on these findings, this study suggests several implications for associated academics and practitioners.

Keywords: Business-to-Business E-Commerce, Longitudinal Study, Sell-Side Web Site, Transaction Process, Web Site Evaluation

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INTRODUCTION

Business-to-business (B2B) transactions supported by the World Wide Web (Web) have become a major portion of all e-commerce transactions (Albrecht, Dean, & Hansen, 2005). The growth of B2B e-commerce is driven from a business desire to reduce transaction costs through the e-commerce platform, and to enhance their global competitiveness. A Web site provides the ability for businesses to create value by aligning themselves with their customers and suppliers in B2B e-commerce. In this scenario, the Web site supplies e-commerce with a platform which allows multiple businesses buy and sell goods and services from different locations. This Web-based application has been integrated with B2B transaction activities, and will become more critical to B2B commerce in the future. Companies can contact business partners in a timely fashion and provide product information through a B2B Web site via the Internet. Nevertheless, companies can exploit more opportunities for strategic alliances and collaborations with potential business partners by participating in B2B activities (Ordanini, 2005).

While many classes of B2B Web-based applications are developed, most of them are derived from the idea of sell-side support (Turban, King, Lee, & Viehland, 2006). This type of e-commerce practice focuses on utilizing Web technologies to sell goods or services to multiple business customers, and it usually follows the conventional e-commerce model. Despite Web sites being a powerful e-commerce tool, the degree of Web site support capabilities in the B2B transaction process is unclear. There is a lack of a comprehensive view of how the sell-side B2B Web sites functions fit within the context of the overall relationship and transaction processes. Although a number of previous studies have examined some functions of commercial Web sites (Chu, Leung, Hui, & Cheung, 2007; Yeung & Lu, 2004), few longitudinal studies on how Web sites have developed to support B2B business transaction processes are available in the literature.

This study aids understanding of the evolution of B2B Web sites, and examines how the Web sites which support B2B transaction processes have evolved over a period of time in two countries, New Zealand and Taiwan. The Global Information Technology Report (World Economic Forum, 2007) indicated that Taiwan possesses an excellence of network readiness and is ranked as top level in Asia-Pacific. It seems that companies in Taiwan have greater technological capabilities and readiness to develop the specific field of B2B e-commerce. However, from the other perspective, the emergence of e-commerce has provided more opportunities, such as larger electronic markets and low-cost communication with business partners, for New Zealand companies. Because of its geographical isolation in the world, the advantages of Internet access to international resources of business information and electronic marketplace are relatively important for the small and medium sized enterprises in New Zealand. It is expected that New Zealand companies have greater intention to utilize Web sites support B2B transaction processes.

Despite these suspicions, from the overall perspective, the evolution of e-commerce practices and a larger number of research papers published on e-commerce in the past few years has led us to be more inclined to believe that Web sites have been improved. However, is it true? Have businesses enhanced their Web capabilities in terms of conducting B2B transaction processes virtually? We seek to bridge this gap in the Web evaluation literature regarding sell-side B2B transactions.

To examine how the Web sites which support B2B transaction processes have evolved over a period of time in the two countries, this research evaluated and compared the B2B Web sites in the two countries over a period of six years. The samples evaluated were chosen from sell-side Web sites in the electrical components and computer hardware industries in each country.

The rest of this paper begins with the induction of economies and IT capabilities in New Zealand and Taiwan, and is followed by a

series of literature reviews on B2B e-commerce, B2B transaction process, the roles of Web sites in B2B e-commerce, and Web site evaluation. Then, data collection methods, the chosen evaluation instrument and the evaluation process will be introduced, followed by the data analysis and discussion. Finally, it will summarize the research findings and discuss several implications for academics and practitioners.

INDUCTION OF ECONOMIES AND IT CAPABILITIES IN NEW ZEALAND AND TAIWAN

The estimated population of New Zealand was 4.23 million in 2007 (Statistics New Zealand, 2007). From 2000 to 2007, the average growth in gross domestic product (GDP) was 3.3 percent and annual labor productivity was 1.1 percent (Statistics New Zealand, 2008). The number of businesses in New Zealand was about 463,380 in 2007 and increased 2 percent from 2006 (Statistics New Zealand, 2008). In 2007, there were 57 Internet Service Providers (ISP) in New Zealand, which had a total of 1,464,300 subscribers and had increased 5.9 percent from 2006 (Statistics New Zealand, 2007). Business and government subscribers reached 15 percent of all subscribers and provided 21.5 percent of total revenue (Statistics New Zealand, 2008).

There were 51 percent of New Zealand businesses having a business Web site (Statistics New Zealand, 2007). Almost 10 percent of businesses had a facility for receiving online orders on their Web sites, and usually used email to communicate with suppliers and customers (Statistics New Zealand, 2002). In addition, 80 percent of businesses used IT for accounting and had a formal system to manage business information. Moreover, most businesses in New Zealand had computers (46%) and had computers which were connected to a local area network (44%) (Statistics New Zealand, 2002).

The emergence of e-commerce has provided more opportunities, such as larger electronic markets and low-cost communication with business partners, for New Zealand

companies. New Zealand was ranked as 14th out of 28 OECD countries in terms of the degree of Internet usage in businesses (Statistics New Zealand, 2007). Electronic, finance and wholesale trade industries were the highest Internet usage industries in New Zealand. The major activities for New Zealand businesses on the Internet were finance and receiving orders. Total sales increased through the Internet were estimated to be 523 million in 2001 that raised 0.3 percent of total income (Statistics New Zealand, 2002). Because of its geographical isolation in the world, the advantages of Internet access to international resources of business information and electronic marketplace were relatively important for the small and medium enterprises in New Zealand. Half of New Zealand businesses indicated that they used the Internet for making purchases, and in particular the larger businesses were more likely to use it. Almost 20 percent of businesses described that up to 10 percent of their total sales were through the Internet (Statistics New Zealand, 2007).

With a total population of 23 million in Taiwan, Taiwan relied on worldwide trade because the major economic activities in Taiwan were export-oriented. With the global economy starting to decline, Taiwan has held sustained economic increase in recent years. In external trade, the real exports and imports of goods and services increased 8 percent and 12.3 percent respectively (Taiwan's National Statistics, 2008). Thus, the economic condition of Taiwan provides an excellent environment for companies, in particular international trading companies, to develop their business scale.

The Internet usage level of Taiwan is one of the highest in the Asia area. According to the Institute for Information Industry, a leading Non-Government Organization (NGO) supporting the development of the IT industry in Taiwan, there was a total of 4.7 million Internet subscribers in 2008. The total number of Internet subscribers increased 2 percent from 2007. The Institute for Information Industry reported that Internet users reached 10 million, accounting for 44 percent of the whole population in Taiwan (Institute for Information Industry FIND, 2008).

There were 84 percent of Taiwan businesses which have Internet, 82.6 percent have Broadband Internet and 75.3 percent have Digital subscriber line (DSL) (Institute for Information Industry FIND, 2007).

B2B commerce was still in the initial stage in Taiwan and accounted for 1.4 percent of GDP in 2001. With the development of B2B and B2C commerce in Taiwan, the proportion of B2B commerce was slightly greater than before (Chen, 2003). There were nearly 80 percent of businesses that used e-mail as an internal or external communication tool and nearly 60 percent of businesses went through the local area network to connect internal computers in Taiwan (Institute for Information Industry FIND, 2006). More than 30 percent of businesses will integrate their internal business information into the Enterprise Information Portal (EIP) (Institute for Information Industry FIND, 2006). About 40 percent of businesses in Taiwan have a Web site. However, only 19.4 percent of businesses update or maintain their Web site content (Institute for Information Industry FIND, 2006). Online sale and purchase increased to 9 percent and 12.5 percent respectively in terms of the e-commerce transactions in 2005 (Institute for Information Industry FIND, 2006).

Using the statistics report above, the economic activities and e-business scale continue to grow in these two countries. Based on the Global Information Technology Report (an internationally renowned report), Taiwan possesses an excellence of network readiness and is ranked as top level in Asia-Pacific. This report ranked New Zealand's NRI as 22nd out of the world which is behind Taiwan. It seems that companies in Taiwan have greater technological capabilities and readiness to develop advanced B2B e-commerce initiatives.

B2B E-COMMERCE

B2B e-commerce is defined as "the use of the Internet and Web-technologies for conducting inter-organizational business transactions" (Teo & Ranganathan, 2004, p. 90). In these

transactions, both sellers and buyers are business corporations (Turban et al., 2006). The practice of B2B e-commerce requires related information systems and processes which support the flow of information in the transaction process among the companies (Gebauer, 2002). Historically, companies have carried out electronic data interchange (EDI) to exchange business information before 1990s (Chu et al., 2007). However, the implementation and cost considerations have limited the ubiquity of EDI. As the Web-based technologies expanded, the Internet offers a relatively low cost and efficient alternative to EDI (Fisher, Wong, & Fisher, 2000). Consequently, more and more companies are shifting to the Internet in order to communicate effectively and interact with business partners economically.

There are different classes of e-commerce within the B2B sector (Patel, Schenecker, Desai, & Levitt, 1998; Turban et al., 2006). The primary classes are sell-side (focuses on selling goods or services to customers), buy-side (focuses on helping companies make procurements), and marketplace (an aggregator brings together multiple buyers and sellers) (Cullen & Webster, 2007; Patel et al., 1998). Each of these has its own characteristics.

A sell-side B2B Web site enables an organization to sell products or services to multiple buyers, and usually outside the organization. E-commerce within the sell-side B2B sector includes two major applications. One is the I-Market application which involves catalog and order management, marketing and advertising; the other is a Customer Care application which involves customer relationship management and customer services (Fingar, 2000). Several special characteristics are inherent in sell-side B2B Web site design, for example, it provides a personalized catalog, online payment mechanism, contract negotiation, affiliate program and business alerts (Turban et al., 2006).

Buy-side, and marketplace are the other key classes in B2B e-commerce. Buy-side applications support procurement processes, help organizations to manage spending and acquisition more efficiently, and support the

negotiation of more competitive prices with vendors. An important consideration for buy-side applications is whether they are usable with all potential suppliers (Patel et al., 1998). In addition, a buy-side system should be able to capture all purchasing activities, which will prevent employees from going outside the system for purchasing (Patel et al., 1998).

Marketplace applications are relative newcomers to e-commerce, and only a few online marketplaces exist in specialized industries. Electronic marketplaces can be the hub of B2B activities which facilitate information exchange and business transaction within a particular industry group. Electronic marketplaces can facilitate the integration of multiple suppliers' products or services and help customers search products (Albrecht et al., 2005). Therefore, marketplaces have an ability to bring enormous advantage for associated participants by conducting the trading process with their collaborative company (Son & Benbasat, 2007).

B2B TRANSACTION PROCESS

An e-commerce transaction may exist between various companies which have trading relationships, exchanging business information, receiving orders and payment (Cullen & Webster, 2007). B2C, Customer-to-Customer (C2C) and B2B transactions are all included in the e-commerce transactions (Albrecht et al., 2005). Gebauer and Scharl (1999) used a four-phase model to describe the whole B2B transaction process: information, negotiation, settlement, and after-sales and transaction analysis. Likewise, Schubert (2002) also described that four transaction phases of information, agreement, settlement and after-sales which are existing together at the electronic markets.

The information phase comprises both searching for a particular electronic catalog or source of information, and locating required information and commodities within the information repository (Grieger, 2003). In this phase, customers collect information on potential products and services, meantime, they looking

for possible providers and asking prices (Selz & Schubert, 1998). Negotiations can be distinguished according to their validity, ranging from a single transaction to multiple-year contracts. Most customers in this phase also inquire about price. Factors in pricing may include warranty coverage, volume-based pricing, carrier or logistics preferences, and negotiation in real time (Huff, Meister, & Fenner, 2000). The negotiation phase serves to establish a contract, fixing details such as product specifications, payment, etc. In the settlement phases of a transaction process, activities and procedures are comparatively well defined, as they are part of the contract (Grieger, 2003). The delivery of the goods or services ordered will take place during this phase (Selz & Schubert, 1998). In the after-sale phase, proper access to the transaction file is vital. Without this, communication problems and delays can occur. The information technology support of after-sale activities is heterogeneous and ranges from simple e-mail services to automated helpdesks and sophisticated electronic maintenance manuals.

ROLES OF WEB SITES IN B2B E-COMMERCE

The World Wide Web (Web) is the technology which can provide information and communication functions for e-commerce transactions. Web technology is used to establish market places in cyberspace where buyers and sellers meet, evaluate offerings, and negotiate digitally with little or no restrictions on distance or time. In terms of supporting payment, most e-commerce platforms are B2C which handle payments via third-party payment processors, and few of them are associated with B2B transactions, such as letters of credit, purchase orders, or cost-center codes as payment methods (Huff et al., 2000). The power of e-commerce comes from buyers and sellers being able to conduct the full range of a business relationship on the Web site. The activities involved in the relationship range from creating the initial impression, allowing for competitive comparison, negotiating, and

closing the sale to delivery of the product, and finally to customer service (Fruhling & Diggman, 2000).

Web sites can also be involved in sell-side types of B2B transactions, which facilitate selling products or services to many buyers. Raisinghani et al. (2005) indicated that sell-side B2B should have several characteristics. Firstly, customer registration requires the customer to provide a personal password before being authenticated to use the system. Secondly, displaying new items in the catalog means that personalized online catalogs will provide valued product information to customers. Thirdly, a function to support accepting and checking orders provides the capability for the customer to accept or check their orders via the online systems. Fourthly, online payment support means that payment systems are provided for customers. Fifthly, order history means that data warehousing and data mining can be applied to analyze the customer's history. Finally, complaints and returns mean that customer can conduct after-sale services through the use of communication technologies.

The operation model of sell-side B2B Web sites is similar to B2C since the business also sells products and services to their business customers over the Internet (Turban et al., 2006). The evaluation of Web sites needs to address the issue of how the Web provides support capabilities to sell-side B2B transaction activities virtually. Since B2B e-commerce is becoming one of the most beneficial applications in the e-commerce world, evaluating the support capabilities of Web sites to sell-side B2B transaction activities is also becoming more important.

WEB SITE EVALUATION

Previous researchers have proposed methods for Web site evaluation. Spiliopoulou (2000) utilized Web usage artifact mining for Web site evaluation because this can analyze the information left by users after visiting a Web site, that is, records of the pages they have ac-

cessed. D'Ambra and Rice (2001) developed an integrative model and conceptually-based scales for evaluating the extent to which Web services satisfy information needs that arise outside the traditional organizational domain. Loiacono, Waston, and Goodhue (2002) developed a measure for Web site quality which can be used to predict consumer reuse of the Web site based on the Theory of Reasoned Action (TRA) and Technology Acceptance Model (TAM). Hong and Kim (2004) proposed a set of criteria from an architectural perspective for evaluating Web sites. They indicated that criteria such as internal reliability and external security for structural robustness, useful content and usable navigation for functional utility, system interface and communication interface for aesthetic appeal have different impacts on user satisfaction for different types of Web sites. Huang (2005) provided a new scale that measures Web performance as perceived by consumers. She concluded that the scale can discern the formation of Web performance into the hedonic and utilitarian aspects reflecting Web users' entertainment and information needs.

A group of studies focused on the relationship between the Web site design and user perception. Shneiderman (1997) pointed out the improvement of Web site design may increase users' successful experiences and positive attitudes. The author offered an Objects/Actions Interface Model to consider when designing and evaluating Web sites. Zhang and Von Dran (2000) presented a two-factor model that can guide Web site design and evaluation. Web designers can improve user satisfaction through the understanding of hygiene factors and motivator factors in Web-user interface. Piccoli, Brohman, Watson, and Parrsuraman (2004) validated a descriptive taxonomy of user needs amenable to online fulfillment. They offered a five-stage conceptual model for understanding and predicting the development of a firm's Web site design and functionality. Zviran, Glezer, and Avni (2006) investigated the effect of user-based design and Web site usability on user satisfaction across four types of commercial Web sites. They found that Web

site attributes were plotted on bi-dimensional perceptual maps in order to visualize their interactions. Agarwal and Venkatesh (2002) proposed that the measure of usability can provide a global rating for a specific Web site and also can illuminate specific strengths and weaknesses associated with Web site design.

Several researchers developed and utilized an instrument to measure the quality of a Web site. Barnes and Vidgen (2001) extended and refined WebQual 2.0 by encompassing an interaction-quality perspective on e-commerce Web sites and used it to measure the e-commerce Web sites. Schubert (2002) improved an evaluation tool (The Extended Web Assessment Method, EWAM) specifically created for the assessment of EC applications and illustrated the use of EWAM by an analysis of commercial Web sites.

Another group of Web evaluation efforts is the longitudinal study. Chu et al. (2007) proposed a framework of four stages of evolution of e-commerce Web sites. These are pre-, reactive, interactive, and integrative Web eras. E-commerce Web sites evolved from an early pre-arranged closed environment to a more open and one-way browsing medium, and eventually to supporting secure two-way commercial processes. The latest stage in the framework depicts Web sites as a technology not only supporting online trading activities, but also integrating the management of e-business processes that occur between any business parties. They conducted a longitudinal study on three trade magazines from 1993 to 2001. The results confirmed the proposed framework. They argued that the development of Web technology and the evolution of e-commerce activities had a strong relationship. In contrast to a general impression of fast growing e-commerce activities, Yeung and Lu (2004) studied Hong Kong-based commercial Web sites for a period of 2.5 years, and found that the Web sites sampled generally grew larger in content. Yet, their functions were only marginally enhanced over that time.

Apart from the evaluation of commercial Web sites, Hackett and Parmanto (2005) conducted a longitudinal study on 45 higher education Web sites for years 1997 to 2002

to evaluate their accessibility, and the results showed that the Web sites of higher education institutions are increasingly inaccessible to all, including persons with disabilities. Ortega, Aguillo, and Prieto (2005) compared the contents and elements in the scientific Web sites at two different points of time – 1997 and 2004. Their results confirmed a growth of Web contents and elements in the Web, although there is also a high degree of Web content decay. In addition, the Web is characterized by both strong dynamism and instability over the seven year period. Bar-Ilan and Peritz (2004) analyzed the change that occurred to a set of Web pages related to informetrics over a period of five years between 1998 and 2003. The results showed that nearly 40 percent of the documents disappeared and about half of the remaining pages were modified. Almost all current models of the Web consider growth only. They concluded that modification, disappearance, and resurfacing cannot be ignored when studying the structure and development of the Web.

Users are now benefiting from various services offered from commercial Web sites such as on-line product order, product search and comparison, and product-altering. Researchers have proposed various techniques or criteria to evaluate Web sites in order to differentiate between merits and drawbacks. Tan, Liu and Bishu (2009) compared the efficiency and effectiveness of utilizing user testing and heuristic analysis methods in evaluating different commercial Web sites, and suggested that the two are complementary and should not be competing. To generate better evaluation results, both user testing and heuristic analysis are needed. Breckons, Jones, Morris, and Richardson (2008) aimed to review available evaluation instruments and to assess their performance when the instrument is used for evaluating Web sites. A total of 39 instruments were identified in their study, and their applicability was demonstrated by evaluating 12 Web sites. They found that evaluation instruments which combine better features and are easy-to-use can offer gateway providers or Web design companies a method of efficiently assessing a large number of Web sites.

In summary of the discussion above, Web sites seem to play a critical role in supporting various kinds of processes including e-commerce processes. The appearance of Web sites, particularly in certain industries, has changed markedly over time. Previous studies have proposed evaluation criteria for rating the content of Web sites and the accessibility of Web sites. They also provided different methods for evaluating and observing Web evolution longitudinally. Previous discussions also found that most of sell-side B2B transactions are based on information, negotiation, settlement, and after-sales stages.

Although the evaluation of Web sites has been carried out from a variety of perspectives, few of those studies examine how Web sites support B2B transaction processes empirically. The degree of support capabilities of Web sites for B2B transactions is currently still vague. This study thus fills in this research gap and provides useful insights into the differences of Web support capabilities in different industry contexts in two countries. It provides knowledge about the extent to which sell-side B2B sites possess the capabilities needed to effectively support different stages of the transaction process for users.

METHODOLOGY

Sampling

To advance our understanding, this study utilizes the instrument originally developed by Hung (2001), which later appeared in Hung and McQueen's work (2004), to evaluate Web sites in order to understand the changes in the support capabilities of B2B Web sites over time in New Zealand and Taiwan contexts.

This study chose samples from the Web sites listed under B2B category in both Yahoo New Zealand and Yahoo Taiwan search engines in 2001. Under each B2B category, the electrical components and computer hardware industrial categories were chosen for study since they

were considered as more advanced in using Web sites at that time. Electrical components include industrial electrical components, such as cables, plugs, industrial power supplier, and other large equipments. Computer hardware refers to computers, computer parts/components, and relevant components that users can physically touch. The companies which belong to more than one category (e.g. belong to both computer hardware and electrical components) were eliminated. These companies were under the sub-category with the "@" symbol is appearing at the end of it. Since this research accessed online directory for Web site studies, the companies listed in each sampling frame were numbered in order to select the sample randomly (McMillan, 2000). All names and uniform resource locators (URLs) of the Web sites in all sampling frames were listed and numbered into the database. A systematic sampling method (Zikmund, 1999) was chosen to draw samples from sampling frames. Every third element number on the list was selected randomly. However, if the Web site was mainly a B2C (e.g. retailer's Web site), or a buy-side, market place, or purely service oriented site, it was not used for this research. When the site was eliminated, the nearest site was chosen. Also, only English version sites were chosen in this study.

Initially, 40 Web sites were selected for this research in January 2001. There were 15 samples each from electrical components category in Yahoo New Zealand and Yahoo Taiwan, and five each from computer hardware category in Yahoo New Zealand and Taiwan. Interestingly, the five sites in the New Zealand computer hardware category were all valid samples in the sampling frame in 2001 since the other four sites were unsuitable for the purpose of this research.

Only 33 Web sites were accessible, as seven Web sites were no longer present. We provide a listing of sampled B2B Web sites in Appendix A. The valid sample sizes in the four sampling frames in 2001 and 2007 are shown in Table 1.

Evaluation Instrument and Its Development

This study measured B2B Web sites from the user's perspective. Guest users often have less experience than frequent users in dealing with business transaction processes via the B2B Web site. Thus, the degree of support capabilities in transaction processes will be an important issue to guest users. The instrument developed by Hung and McQueen (2004) can be utilized for measuring user satisfaction on sell-side B2B Web sites particularly from the user's perspective. In this study, we evaluated the support capabilities of sell-side B2B Web sites and empirically analyzed the improvement of Web functions which were used to support the activities in the transaction processes in order to offer valuable implications for researchers and practitioners to understand B2B Web site evolution and to establish e-commerce strategies.

The essential idea of the instrument is to have an overall understanding of the Web services provided by the Web site, and to identify which Web function is available or not available from the Web presence when a guest user is attempting to conduct the whole B2B transaction process. Hung and McQueen (2004) identified three failure points that hinder the completion of the transaction process and the creation of

customer satisfaction: (1) buyers cannot access the Web site or find the function or information they want; (2) the function does not work or buyers do not know how to use the function or the information is useless; and (3) buyers do not feel satisfied although they may not be dissatisfied. Four suitable criteria measurements will appear when users reach each of three failure points: ease-of-identification, ease-of-use, usefulness and interactivity.

The definitions of these four criteria are given as (1) ease-of-identification: includes connectivity and ability of identification, (2) ease-of-use: refers to how easy it is to use the function to achieve the goal of users, which includes navigability and user friendliness, (3) usefulness: refers to whether a Web application would be helpful to the users, or potential clients and customers, in accomplishing their intended purposes, and (4) interactivity: refers to Web content serves users as a powerful expert and communication tool to achieve their desires.

To ensure the reliability and validity of the instrument, Hung and McQueen (2004) performed several testing and revising steps. Firstly, evaluators from different disciplines were asked to use the draft instrument and to evaluate the same e-commerce Web site at the same time. If any significant difference among their results was found, some modifications

Table 1. Sample distribution

Total numbers of B2B Web sites listed in Yahoo in 2001		
	Electrical components	Computer hardware
New Zealand	19	9
Taiwan	136	15
Sample size in each sampling frame		
	Electrical components	Computer hardware
New Zealand (2001)	15	5
Taiwan (2001)	15	5
Total sample in 2001	40	
New Zealand (2007)	14	5
Taiwan (2007)	10	4
Total sample in 2007	33	

would be made to the instrument. In turn, participators were required to evaluate another e-commerce Web site until the difference in the results was not significant. For the validity in the instrument, one evaluator was required to use the instrument to evaluate sample B2B Web sites and differentiate them. Consequently, feedback and many suggestions were generated and contributed to adjust the instrument. The final version of the evaluation instrument, as shown in Appendix B, includes fourteen transaction activities, four evaluation criteria, and relevant instructions. More details about the development of the instrument can be found in Hung and McQueen's (2004) study.

Evaluation Process

The 40 Web sites sampled in 2001 had been revisited in 2007 by the same evaluator who was involved in the evaluation instrument development process. The evaluator was asked to start his evaluation from the homepage of the B2B Web site. Using the instrument, the evaluator tried to find all Web functions given in Column 1. If the evaluator found any new Web function which was not listed in the evaluation, it was recorded by a note which described under what hyperlink item the function was found in Column 2. If the function was found on the homepage, he would place a "√" in Column 2. If not, he moved to the next function. The next step was to execute each of those activities which had been ticked, by clicking its function item. Then, he completed Column 4 by using criteria forms 1 and 2. He also conducted those new activities which were found during the investigation, and then completed Column 4. Based on the scoring systems, the Web function received 10 marks when it got A. If the function is not working, it received a total of 0.

Since the instrument was designed to be used by guest users, who have no passwords, password-protected functions have to be treated differently than guest-accessible functions, such as company overview. In the end, there were six companies which required login in 2001, and seven in 2007. For those password protected

functions, the evaluator used criteria form 2 to evaluate. The function was assessed on how much helpful information it could provide and its degree of interactivity. The high score meant that it can highly satisfy a guest user.

We used the single coder approach in this study. This procedure has the advantage of employing insider knowledge to minimize the number of ambiguities and the amount erroneous coding (Schmidt, Schneider, Utts, & Walach, 2004). Alternatively, it may be more reliable and cost effective to provide a single coder with a period of training before setting them the task of coding a full data set (Milne & Adler, 1999). The coder employed in this research gained his expertise and knowledge from participating in previous research projects (Hung, 2001; Hung & McQueen, 2004) which are highly relevant to this research, and was involved greatly in the development process of the utilized evaluation form. Thus, the use of this expert coder can minimize coder biases.

In addition, the reason for adopting the same evaluator in this study is that the using different evaluators in 2001 and 2007 may cause bias to the comparison of the same Web sites. Furthermore, the coder has not accessed the evaluated Web sites between the first and second assessments, as well as the fact the companies had vastly changed the content of Web site over the six years. Thus, there is very little possibility that the coder still remembered the content and structure of Web sites previously evaluated.

RESULTS AND DISCUSSION

This section outlines the results of evaluating the 33 B2B Web sites sampled. It starts from showing the average scores of Web sites sampled in 2001 and 2007. Secondly, it compares the scores of the Web sites, describes their improvement in the study period, and presents the scores of the functions and the improvement in each function of the Web sites. Finally, the B2B Web site scores and the scores of Web functions in different industry groups are compared.

Scores of Web Sites Sampled

The average scores of Web sites sampled in New Zealand and Taiwan from 2001 to 2007 are shown in Table 2. In the New Zealand category, the average score is 151.4 in 2001 and 160.6 in 2007. In the Taiwan category, the average score is 132.3 in 2001 and 152.8 in 2007. These scores have increased denoting that the companies sampled tend to place more emphasis on the design of Web sites to support transaction processes. Surprisingly, the New Zealand category score is higher than that of Taiwan in both years. The New Zealand category score is higher than that of Taiwan by 19.1 points in 2001 and by 7.8 points in 2007. This finding reveals that New Zealand B2B Web sites provide greater support abilities for users to conduct business transactions on the Internet. New Zealand companies possibly have more advanced techniques than Taiwan in terms of developing Web sites to support the B2B transaction process.

Despite its very good information infrastructure, Taiwanese B2B Web site scores are lower than those of New Zealand. As discussed previously, most New Zealand companies rely on the Internet to conduct business transactions in 2001 (Statistics New Zealand, 2002). This tendency has been evident earlier and more widely spread in New Zealand's companies than Taiwanese companies. Because of the geographical isolation in the world, the advantages of the Internet access to external information and resources are relatively important for companies in New Zealand.

New Zealand and Taiwan are both island countries, and import and export trading are important in their overall economic activities.

However, the geographical locations of New Zealand and Taiwan are different – in the Southern and Northern Hemispheres respectively. For any country, the superiority of geographical location serves as the facilitator to enhance the convenience of trading. As a remote country, the capabilities of online promotion and transaction for New Zealand companies become a crucial factor to their international marketing (Statistics New Zealand, 2007). This could be another reason for explaining why the supporting capabilities of New Zealand Web sites are better than those of Taiwan.

Scores of Web Sites and Web Functions Sampled

The changes of scores of Web sites sampled in New Zealand and Taiwan are presented in Table 3. The score means the total score of the site being evaluated by the instrument. The higher score reflects lower operational barriers for the user to conduct B2B transactions. In the New Zealand category, 12 of the B2B Web sites sampled improved in the study period. Nine of the B2B Web sites sampled improved in the study period in the Taiwan category. Overall, the abilities of Web sites in supporting the B2B business transaction process are increased rather than reduced in the study period.

This study utilized a paired samples *t*-test to examine the significance of statistical differences of the improvement on the scores for Web sites sampled during the study period. The paired samples *t*-test was used to test the differences between two related samples between 2001 and 2007. The results show that the differences between the sample scores in the two sample years in Taiwan are statistically significant (*t*-statistic = -1.8, *p* = 0.095) at 90%

Table 2. Average scores for the web sites sampled

Year	2001		2007	
	New Zealand	Taiwan	New Zealand	Taiwan
Country				
Number of Web sites	19	14	19	14
Average scores	151.4	132.3	160.6	152.8

Table 3. Scores of New Zealand and Taiwan B2B web sites from 2001 to 2007

New Zealand				Taiwan			
Co.	Scores (2001)	Scores (2007)	Improvement/ Deterioration	Co.	Scores (2001)	Scores (2007)	Improvement/ Deterioration
1	93	123	+	1	82	132	+
2	248	135	-	2	64	98	+
3	115	156	+	3	62	129	+
4	54	91	+	4	99	63	-
5	74	163	+	5	149	141	-
6	191	90	-	6	241	270	+
7	74	69	-	7	214	266	+
8	89	69	-	8	64	65	+
9	94	212	+	9	96	95	-
10	152	67	-	10	54	69	+
11	67	84	+	11	65	189	+
12	106	20	-	12	251	239	-
13	59	137	+	13	202	169	-
14	121	151	+	14	211	218	+
15	205	243	+				
16	158	195	+				
17	444	202	-				
18	171	404	+				
19	367	445	+				
+ = the improvement in scores between 2001 and 2007 - = the deterioration in scores between 2001 and 2007							
				Country			
				New Zealand		Taiwan	
Mean (Score ₂₀₀₁ - Score ₂₀₀₇)				-9.2		-20.6	
S.D. (Score ₂₀₀₁ - Score ₂₀₀₇)				103.2		42.9	
df				18		13	
t-value				-0.4		-1.8	
p-value				0.700		0.095*	

* p < 0.1

confidence levels, yet the differences in New Zealand are statistically insignificant (t-statistic = -0.4, p = 0.700). This finding means a significant improvement of Taiwanese B2B Web sites scores is found but not in the samples of New Zealand B2B Web sites in the study period.

Based on the Table 3, there is a significant improvement of Taiwanese B2B Web sites scores. This is possibly due to the Taiwan government promoting e-Taiwan programs from 2002 to 2007. The goal of e-Taiwan programs was to facilitate the development of a good Taiwanese information and communications

environment. The scope of these programs included e-Infrastructure, e-Government, e-Industry and e-Life in Taiwan. These programs resulted in a significant improvement in ICT infrastructure and a better environment to facilitate Taiwanese companies to advance their Web-based transaction technologies (Taiwan Executive Yuan, 2007).

The scores of each Web function in the Web sites sampled are presented in the Table 4. The score for each function is the total score of the function that has been evaluated by using the instrument. The higher score denotes fewer operational barriers for the user and means that the user perceived usefulness and satisfaction from the use of the Web function. A Wilcoxon signed rank test is performed to establish whether the score of functions changed over time, and 0.1

is chosen as the threshold for statistical significance. The results are presented in Table 4. In terms of New Zealand, the improved Web function is function 1.3 (privacy description, $p = 0.012$) and the declined Web function is function 1.1 (company overview, $p = 0.023$). In terms of Taiwan, the improved Web functions are function 1.2 (financial information, $p = 0.043$) and function 1.4 (product catalog, $p = 0.059$).

The score of function 1.1 in the New Zealand category is 514 in 2007 which is lower than that category in 2001 (573). This indicated that function 1.1 has significantly deteriorated in New Zealand samples, and this implies that New Zealand companies ignored the development of function 1.1 on their B2B Web site in the years measured. New Zealand companies would consider function 1.1 as a

Table 4. Comparisons of New Zealand and Taiwan B2B web function from 2001 to 2007

Function	New Zealand				Taiwan			
	Scores (2001)	Scores (2007)	Sig.	Improvement/Deterioration	Scores (2001)	Scores (2007)	Sig.	Improvement/Deterioration
1.1 Company overview	573	514	0.023**	-	443	469	0.195	+
1.2 Financial information	113	66	0.273	-	91	181	0.043**	+
1.3 Privacy	71	271	0.012**	+	0	83	0.102	+
1.4 Product catalog	722	729	0.653	+	459	523	0.059*	+
1.5 New product announcement	251	187	0.624	-	111	70	0.684	-
1.6 News	331	412	0.289	+	252	275	0.965	-
1.7 Learning information	248	284	0.515	+	40	93	0.713	+
2.1 Order	104	90	0.767	-	23	27	0.655	+
3.1 Payment	46	19	0.285	-	0	0	1	=
3.2 Monitoring goods	27	21	0.655	-	15	0	0.317	-
3.3 Exchange document	0	0	1	=	15	27	0.317	+
4.1 Maintenance	218	251	0.514	+	191	220	0.463	+
4.2 Training information	42	80	0.184	+	42	70	0.154	+
4.3 FAQ for customer support	133	130	1	-	174	104	0.237	-

* $p < 0.1$ ** $p < 0.05$

Function 1.1 to 1.7 belong to Information stage; Function 2.1 belong to Negotiation stage;

Function 3.1 to 3.3 belong to Settlement stage; Function 4.1 to 4.3 belong to After-sale stage

basic function in B2B Web sites and it is still more informative than other functions. Therefore, advancing the support capabilities for function 1.1 attracts less concern.

The score of function 1.3 in the New Zealand category is 271 in 2007 which is higher than that category in 2001 (71). This means that function 1.3 has significant improvement and attracted more concern from New Zealand companies in the study period. This study discovers that more companies in New Zealand pay attention to explain their security systems and release privacy statement on their Web sites. A transactional B2B Web site facilitates business transaction processes, such as products or services selection and online ordering. The most common concern for business partners is revealing sensitive business information over the virtual channel (Liu, Marchewak, Lu, & Yu, 2005). Therefore, owners of seller-side B2B Web sites take the privacy issues seriously in transaction processes and provide privacy policies on their Web pages.

The score of function 1.2 in the Taiwan category is 181 in 2007 which is higher than that category in 2001 (91). This shows that function 1.2 has significant improvement in the Taiwan companies studied. Providing financial information about companies is important while companies are in the virtual transaction environment. Clear financial information supplied on the Web site could help Taiwanese companies build customer relationships and enhance their trust through the timely provision of current business conditions.

The score of function 1.4 in the Taiwan category is 523 in 2007 which is higher than that category in 2001 (459). This means that function 1.4 has also improved partial significantly in the study period. Most of Web sites sampled in Taiwan, and even in New Zealand, provide information to introduce products and services. This implies that sell-side B2B Web sites go online for a most important purpose – to tell customers what they are selling. In addition, the advantage is that companies can update the product catalog efficiently without adding extra expenses by printing and post-

ing product catalogs. This function also lets customers select goods or services efficiently, and quickly provides users with notices about new product information.

Comparison of Electrical Components and Computer Hardware Web Sites

The comparisons of scores of Web sites sampled in two industries in 2001 and 2007 are shown in Table 5. Overall, New Zealand and Taiwan Web sites are scored similarly regardless of whether they are in the electrical components or computer hardware category. The average score for New Zealand computer hardware sites is 268.7 and only 182.1 for Taiwanese in 2001. Similarly, New Zealand computer hardware sites are 297.7 and only 203.4 for Taiwanese in 2007. Among the study categories, New Zealand computer hardware sites have the highest average scores. While comparing the industries, computer hardware sites are scored higher than electrical components sites in both countries. Most of the computer hardware B2B Web sites are scored higher than electrical components during the study period. This reveals that computer hardware sites have much higher ability to support business transaction than electrical components sites do at this moment.

To understand more, it is necessary to compare more evidence regarding to the two industry groups. The results are presented in Table 5. No difference in Web site scores are found between two industry groups in Taiwan in 2001 (Mann–Whitney U-test, $p = 0.157$). Yet, there is significant difference between electrical components Web sites and computer hardware Web sites in Taiwan in 2007 (Mann–Whitney U-test, $p = 0.09$). In New Zealand, the differences are both significant between two industry groups in 2001 (Mann–Whitney U-test, $p = 0.005$) and in 2007 (Mann–Whitney U-test, $p = 0.002$).

Electrical components and computer hardware B2B Web sites in New Zealand are scored differently in terms of the average scores in 2001 and in 2007. This finding implies that

Table 5. Test of difference of web scores in two industry groups

Year	New Zealand				Taiwan			
	2001		2007		2001		2007	
Industry groups	E	H	E	H	E	H	E	H
Number of Web sites	14	5	14	5	10	4	10	4
Average scores	106.0	268.7	111.7	297.7	112.3	182.1	132.6	203.4
Mann-Whitney U	5		2		10		8	
p- value	0.005***		0.002***		0.157		0.090*	

E = Electrical components industry H = Computer hardware industry

* $p < 0.1$ *** $p < 0.01$

computer hardware companies invest more effort in their Web sites to support B2B transaction process including performing their online order or payment, receiving orders, and delivering after sales services.

This study also finds no difference in the scores between electrical components and computer hardware B2B Web sites in Taiwan in 2001. As mentioned previously, Piccoli et al. (2004) proposed that the first stage of Web site development is growth through experimentation. The purpose of the Web site in its youth stage was more document publishing in order to enable customers to see information about the company and is similar to other companies where Web sites are basically publishing product information. As Taiwanese B2B e-commerce was still in its youth stage in 2001, the country's computer hardware and electrical components companies might utilize similar template and design knowledge. At that time, the attributes and characteristics of these two industries might not have been incorporated into Web designs.

Although the Web designs were not significantly different in 2001, the nature of products and customer requirements are essentially dissimilar between the two industries. The sellers might need to address these specific needs and deliver the distinctive services to their customers via the Web site when revamping it after 2001. As found by Piccoli et al. (2004), when the firms in the same industry focus on the specific needs of their customers, significant within-industry convergence – a new dominant design around

Web site functionality is likely to emerge. This possibly can explain why computer hardware and electrical components companies would perform differently in terms of Web design, and thereby cause the significant change in Web scores in 2007.

For a more detailed discussion on the developments of Web functions, the average scores of each Web function in electrical components and computer hardware sites in 2001 and 2007 are shown in Table 6.

The B2B Web sites sampled provide several core functions to support users in performance of their business activities over the Internet. Based on previous research, non-transaction-related interactivity and informativeness are found relatively important for customers performing tasks in a B2B Web site (Chakraborty, Lala, & Warren, 2003). Based on the results, the functions with highest average scores are product catalog (F1.4), company overview (F1.1), and news (F1.6) in both 2001 and 2007. These are considered as core functions to supply promotional information for users via Web sites. Chakraborty, Srivastava, and Warren (2005) indicate that the informativeness of a B2B Web site is important for its visitors. Our results also show that, fundamentally, establishing a transactional B2B Web site is the promotion of business to its users. Most of the samples do provide an introduction of the company to their users.

Overall, of the fourteen functions compared, computer hardware samples indicate

Table 6. Average scores of web functions between two industry groups

	Function	2001		2007	
		Electrical components	Computer Hardware	Electrical components	Computer Hardware
1.1	Company overview	28.7	36.2	26.9	37.4
1.2	Financial information	5.4	8.2	6.3	10.6
1.3	Privacy	0	7.8	5.8	23.7
1.4	Product catalog	32.9	43.6	36.4	42.1
1.5	New product announcement	9.7	14.2	4.4	16.7
1.6	News	13.1	29.8	14.0	38.8
1.7	Learning information	7.1	13.0	10.6	13.6
2.1	Order	1.8	9.3	3.1	4.8
3.1	Payment	0	5.1	0	2.1
3.2	Monitoring goods	0.6	3.0	0	2.3
3.3	Exchange document	0.6	0	1.1	0
4.1	Maintenance	5.6	30.4	4.3	40.8
4.2	Training information	0	9.3	2.9	8.9
4.3	FAQ for customer support	5.1	20.4	4.5	13.9

Function 1.1 to 1.7 belong to Information stage; Function 2.1 belong to Negotiation stage;
Function 3.1 to 3.3 belong to Settlement stage; Function 4.1 to 4.3 belong to After-sale stage

higher average scores than electrical components samples except for the exchange document function (F3.3). This shows that computer hardware sites have higher support capabilities for users to conduct B2B transaction processes via the Internet. However, the payment function only scored in the computer hardware industry category. This shows that the payment solution is not widely provided by electrical components B2B Web sites in New Zealand and Taiwan. According to the comparison of functions in Phase 4 (after sales activities), computer hardware Web sites provide much better services for buyers after the product has been sold.

Comparisons of Findings of Previous Studies

Previous Web evaluation studies tended to investigate real world problems and issues in Web site development in order to provide solutions for future improvement. This study summarizes

several key studies in Table 7 for the purpose of discussing the comparisons between our findings and those of previous studies.

When focusing on the content and design of commercial Web sites, Huizingh (2000) revealed that different industry groups have different emphases. The consideration of Web content and design is highly relevant to the goals of the company and the perception of targeted users. However, under certain cases, users are hard to identify for an international company. In previous studies, there are a few studies which detail the differences between Web sites in different industry groups. In comparison, we confirm Huizingh's (2000) findings and argue that the differences between Web sites do exist. Computer hardware sites have higher ability to support business transaction than electrical components sites. This study also proposed a framework for these two industries to diagnose their Web site support capabilities in more detail, and identify where

Table 7. Comparisons with previous findings

Source	Subject	Research findings
Huizingh (2000)	561 commercial Web sites from 5 industries	He concluded that different industry companies are using the Web for different commercial purposes, based on industry, the content and the design of Web site significant differences were revealed.
Piccoli et al. (2004)	30 commercial Web sites from 10 different industries	Web site features that address the customer needs for service-specific knowledge are strongly associated with the general information, rather than the specific information, service dimension.
Yeung and Lu (2004)	98 Hong Kong-based commercial Web sites	The Web sites sampled generally grew larger in content; their functions were only marginally enhanced over time, in contrast to the general impression of fast growing e-commerce activities..
Heinze and Hu (2006)	500 Standard & Poor's company Web sites	They found a continuing trend towards increasing numbers and types of features offered, suggesting that large companies are placing greater importance on customer orientation to their Web sites in an effort to create positive impressions about their companies.
Chu et al. (2007)	A longitudinal study based on articles in <i>Internet World</i>	Web site integrative core functions constituted the primary interests of the magazine. The peak in the interactive era was gradual; the onset of the integrative era, in 1999 was followed by a small dip in the anticipated activities of that era the following year.
Schmidt, Cantalops and Santos (2008)	167 hotel Web sites	They found that small and medium size hotels are using their Web sites as mass media tools; however, hotels are ignoring the potential for interactivity and one-to-one communication.
Westbrook (2008)	172 police department Web sites	The level of information provided is clearly insufficient for critical, police-related, general, and long-term information needs.

the improvement should be placed. This diagnosis system is missing in previous literature.

Piccoli et al. (2004) concluded that firms are currently comfortable with providing general information and basic transaction support, but are difficult to provide extensive interactive services. We confirm Piccoli et al.'s (2004) findings. As shown in our results, introducing product and company are considered as two basic purposes for suppliers to launch their Web sites to communicate with buyers. While providing general information about companies and products are basic functions, few Web sites provide transaction support for their buyers. We also found that providing interactive services is not a common practice among B2B Web sites.

Three previous studies have depicted different pictures of the evolution of EC Web sites. Chu et al. (2007) suggested that the reactive era ended around 1995, the interactive era was between 1996 and 1998, and the integrative era began in 1999. Heinze and Hu (2006) detected

that the presentation of S&P 500 company Web sites has undergone significant transformation such as the increasing levels of information, interactivity, and service offered at their Web sites between 1997 to 2003. Yeung and Lu (2004), however, revealed that the Hong Kong-based commercial Web sites showed only marginal enhancement in their commercial functions during the period of 1997 to 1999. Our findings tend to confirm the study results of Yeung and Lu (2004) since we found out that most Web functions were only marginally enhanced over time overall, and some New Zealand Web sites have decreased rapidly from 2001 to 2007. Interestingly, Heinze and Hu (2006) focused on larger companies, whereas our samples include different sizes of companies. Perhaps company size is one of the reasons causing these various findings.

Schmidt, Cantalops and Santos (2008) performed a survey to discover the characteristics and effectiveness of hotel Web sites. The results

suggested that hotel Web sites respond inefficiently to customer demands for commercial transactions. Westbrook (2008) detected that user demands are not commonly considered, and this has caused the information released on the Web site to be insufficient. These recent studies mentioned above call for a focus on the user's perspective including their needs and wants. Since this study adopted the user's perspective to evaluate Web sites, it provides valuable suggestions to complement the content of previous studies.

Chen and McQueen (2008) conducted an intensive literature review regarding EC adoption, and pointed out that the adoption of EC typically covers four stages. The first stage is the messaging stage, and its main activity is basic Web site communication. The second stage is the online marketing stage, and its main activities are Web site advertising and communication. The third stage is the online ordering stage, and its main activities are online shopping and ordering. The last stage is the online transaction stage, and its main activity is online payment.

A comparison made between the main activities in their stage model and the Web functions contained in our instrument shows that the EC activities in their stages are mainly corresponding to the Web functions in the information (Web function 1.1-1.7) and settlement (Web function 3.1-3.3) phases in this study. They asserted that if all four stages are completed, the company will move from simple EC into full e-business. However, a full e-business not only requires the EC activities contained in Chen and McQueen's (2008) stages to be completed over the Web site, but also more activities relevant to negotiation and after sales services. Thus, the transaction phases employed in this study added the negotiation and after-sale phases into the instrument in order to evaluate the more complete supporting capabilities of a Web in the EC transaction process conducted between companies and buyers.

Chen and McQueen (2008) also identified several inhibitors in each of the EC adoption stages. In spite of a wide perception that EC activity is fast growing, this research found

that a portion of New Zealand Web sites have decreased rapidly, and most Web functions were only marginally enhanced over time. We may borrow Chen and McQueen's (2008) findings to explain why those Web sites have scores decreased rapidly. It is suspected that the inhibitors may prevent the evolution of companies' Web sites.

Implications

This longitudinal study has several implications for associated academics and practitioners. For the government in Taiwan, this study suggests that Taiwanese government should think about how to help e-commerce businesses to take advantage of the IT infrastructure that the government has been building over the past decades. The Taiwan government has been funding a number of IT high speed network infrastructure projects in the past two decades, which has raised the infrastructure in Taiwan to a world class level, and transformed the country into a so-called "IT Island". However, the capabilities of Taiwanese B2B Web sites in supporting B2B transaction processes are still weak in comparison with their New Zealand counterparts. The Taiwanese government should, therefore, assist e-commerce businesses in a better development of their Web sites in order to effectively utilize the advantageous IT network infrastructure.

For Web designers, the fourteen functions provided in the evaluation form may assist Web site designers in exploring the full potential of Web technologies that can support B2B transaction processes. These activities are derived from the four phases of the B2B transaction process - information, negotiation, settlement, and after-sale. This study found that current Web sites in the industries of electrical components and computer hardware in New Zealand and Taiwan are not fully supporting these transaction activities. This has left various places for Web designers to carry out future improvement and development of their B2B Web sites.

For businesses, managers can perform the evaluation process employed in this research to

check the weaknesses of their Web sites and to formulate appropriate Web site strategies according to their business model in B2B e-commerce. However, there may be a reason for not including a particular function since the need of any Web function can be driven by current business needs. Although the deployment of a particular function in Web sites is sometimes highly relevant to business needs or goals, providing full support capabilities from the Web site will be more likely to increase guest user satisfaction. Therefore, these fourteen functions should be carefully considered when designing a sell-side B2B Web site.

Building a Web site is a common marketing strategy on the Internet when a company decides to participate in e-commerce activities. However, this does not guarantee that a B2B Web site will have great success in attracting or keeping their customers. B2B Web site design needs to be more customized and interactive, especially to enhance the degree of supporting capabilities of transaction processes in B2B e-commerce. From the perspective of e-commerce participators, the Internet provides a huge opportunity to interact with customers and transfer data directly. Therefore, the real value for a B2B Web site to the supplier comes from the Web satisfying all the transaction activities required by users. A satisfied user is more likely to be a repeat buyer in the future. This is how the seller benefits from the Web site.

Our results indicated that Taiwanese B2B Web site scores have continued to grow in recent years, while New Zealand Web sites have greater supporting capabilities than Taiwanese. Here is an unambiguous way for Taiwan companies to learn how to develop greater supporting capabilities in their Web sites. The facts suggest that the templates of New Zealand B2B Web sites have sufficient capabilities to support business transactions. Naturally, their Web design architecture has set the benchmark of quality for Taiwan companies to learn and to imitate.

Most companies in New Zealand rely on the Internet to conduct purchases of goods and services. Likewise, the B2B Web sites

in Taiwan can provide an exemplar for New Zealand companies if they attempt to improve the supporting capabilities of their Web sites in after-sale processes.

Future Research

There are seven directions for future research which will build on this study. Firstly, this study encourages academic researchers to conduct follow-up case studies with those New Zealand companies whose scores have decreased rapidly during the measured sector. The purpose of the case studies is to provide us with more detailed information regarding the critical factors which have influenced this apparent decline in the support capabilities in these B2B Web sites.

Secondly, this study deals with sell-side oriented Web sites only, and is concerned with the perspective of buyers to evaluate B2B Web sites. Future work should continue on the creation of an evaluation instrument for assessing buy-side oriented and marketplace B2B Web sites from different perspectives (e.g. repeat users) based on the evaluation instrument utilized. Then, the future research can utilize the newly developed instrument to monitor the evolution of different types of B2B Web sites from other perspectives.

Thirdly, this longitudinal study began in 2001, and few companies had formal B2B Web sites to conduct online transaction processes in these two countries. As the time has passed, more and more companies have invested significant resource in Web sites for B2B e-commerce purposes. This study may assist future researchers in applying this instrument in further longitudinal studies with larger sample sizes in the future.

Fourthly, during the evaluation process, we have noted that the scores of smaller companies are relatively lower than the larger counterparts. Yet, we did not conduct a thorough research on whether the size of companies will affect the Web practices of e-commerce, and if yes, how. Future research can clarify this matter and also assess the support capabilities of B2B Web sites in different industries and re-examine the advancement of their core functions longitudinally.

Fifthly, understanding business model is important to help design successful Web site. Future study can explore what particular Web functions are relevant to specific business model or needs. This will provide Web designers an effective design strategy to support particular business model and needs, and thus ensure the design is aligned with the goals of the business model.

Sixthly, future studies should yield a set of benchmarks such that there is a minimum score below which one could conclude that a function or phase is inadequately supported, and an optimal score above which further enhancement to the function would not significantly improve the experience of the user. Establishing a kind of 'zone of tolerance' for Web site evaluation/user satisfaction could be an opportunity for future work.

Finally, the results showed that no new function was found after the evaluation process. However, as many B2B key companies have been involved in more efforts to exploit the power of e-commerce, more Web functions may be invented in the future. Although this study did not find any new function to be added into the evaluation instrument utilized, to keep pace with the trend, the function list might need to be checked continuously and updated if needed. The evaluation instrument could therefore be valid for evaluating more sophisticated B2B Web site evaluation in different contexts.

Limitations

This study has three limitations which need to be considered. Firstly, the rating system of the instrument is based on four criteria (ease-of-identification, ease-of-use, usefulness, and interactivity) in order to help an evaluator determine the degree of superiority of the Web function in a B2B transaction process. In other words, we made the assumption that the preferences of any given user who use the same Web function are based on the four criteria. For example, we can use the instrument to detect how easy the product catalog can be found in a Web site and how informative the function

is. We assume that any user will consider that having access to more information as well as more sub-functions or hyperlinks comprised in the product catalog will result in a perception that this function is well supported. Hence, this type of evaluation is limited and has ignored other potential user characteristics (such as less information and choice might be preferred) and the actual perception of real users.

Secondly, because some Web functions are protected by password or require the user to conduct an actual transaction with the suppliers, these Web functions could not be evaluated thoroughly in this study. Although this research provided a specific solution and evaluation form 2 to measure these functions, in order to reduce the limitation, the full range of measurement can not be created until they can be fully accessed in the future.

Finally, since the same evaluator has previously assessed the Web site, the second assessment may result in some subjective bias. However, there is a very little possibility that the coder could still remember the structure of Web sites over six years later. If the coder still had some memory, this would only affect the evaluation of ease of identification. Thus, the bias is very small.

CONCLUSION

The ability to satisfy business users and particularly to support them in undertaking transaction processes is critical for a successful B2B Web site. This research has evaluated a sample of sell-side B2B Web sites in New Zealand and Taiwan, and looked at their improvement in terms of supporting B2B transaction processes over six years. This longitudinal study provides useful insights into the differences of Web designs in different industry contexts in two countries, particularly the knowledge about the extent to which sell-side B2B sites possess the capabilities needed to effectively support different stages of the transaction process for users.

Overall, most of the Web sites studied in New Zealand and Taiwan still have potential

for improvement as revealed by the results of this study. Yet, detailed results show that some differences in how the Web sites have changed over time do exist. These differences are described below.

New Zealand Web sites scored, on average, higher than Taiwanese Web sites in both 2001 and 2007. However, the rate of improvement of Taiwanese Web site scores is significant and higher than the improvement degree of New Zealand sample scores in the period measured. Specifically, the support capability of several Web functions, including privacy, company information, financial information and product catalog has improved over the study period.

This study also found that the Web sites sampled in New Zealand and Taiwan provide different support capabilities to the activities in the four transaction phases. Taiwanese Web sites appear to be more concerned with providing after-sale services via the Internet whereas New Zealand Web sites seem more concerned with sharing information. Yet, this study also found the two countries' Web sites share a similar focus on supporting B2B transactions. They both provide strong support for users to conduct product promotion and information provision related activities over the Web environment.

The comparison between two industries – electrical components and computer hardware – also shows that these two industries' Web sites have different support capabilities. The computer hardware sites generally show higher capabilities to support B2B transaction activities than their electrical components counterparts. Particularly, they provide more information about after-sale services to buyers, such as maintenance information and FAQ.

Without a doubt, a Web site is a powerful weapon for sellers. However, this research found that the current Web sites in the industries of electrical components and computer hardware in New Zealand and Taiwan are not supporting the whole transaction process fully. The real value for a B2B Web site would be gained if it supported all transaction activities required by users. When this is achieved, users would be more likely to become repeat buyers in

the future. Suppliers who wish to succeed by providing excellent Web services need to pay more attention to enhance their Web support capabilities.

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APPENDIX A

Table A1. Sampled B2B web sites

Company Name	URL	Category
Keam Holden	http://www.kha.co.nz/	NZ/Electrical components
PDL Holdings	http://www.pdl.co.nz/	NZ/Electrical components
Siemens New Zealand	http://www.siemens.co.nz/	NZ/Electrical components
Watchman Electronics	http://www.watchmanproducts.com/	NZ/Electrical components
Active Components	http://www.active-components.co.nz/	NZ/Electrical components
Bluewater Systems	http://www.bluewaternz.com/	NZ/Electrical components
TLA Microsystems	http://www.tla.co.nz/	NZ/Electrical components
Rotational Power	http://homepages.ihug.co.nz/~smel	NZ/Electrical components
WEG Electronic Moters NZ	http://www.weg.co.nz/	NZ/Electrical components
Enertec Services	http://www.enertecservices.co.nz	NZ/Electrical components
Alcom Communication	http://www.alcom.nz/	NZ/Electrical components
ETS Marketing	http://ets.co.nz/about.htm	NZ/Electrical components
Sino-American Electronic	http://manufacture.com.tw/~sinoz/	NZ/Electrical components
Utron Technologies Corp	http://www.utron.net/	NZ/Electrical components
Fuhjyyu Electronic	http://www.fuhjyyu.com.tw/	TW/Electrical components
Litai Electronic Enterprise	http://www.litai.com/	TW/Electrical components
Chily Precision Industrial	http://www.chily.com	TW/Electrical components
Apack Technologies	http://www.apack.com.tw/	TW/Electrical components
Universal Scientific	http://www.usi.com.tw/	TW/Electrical components
Silicon Integrated Systems	http://www.sis.com.tw/index-1.htm	TW/Electrical components
Untied Microelectronics	http://www.umc.com/index.html	TW/Electrical components
De Li Shin Yeh Co	http://www.colorful-deliocom.tw/	TW/Electrical components
DPCOM Inc	http://www.opcom.com.tw/	TW/Electrical components
Actronic Limited	http://www.actronic.co.nz/	TW/Electrical components
Fujitsu New Zealand	http://www.fujitsu.co.nz	NZ/Hardware
Acer New Zealand	http://www.acer.co.nz/	NZ/Hardware
Gateway 2000 New Zealand	http://www.gw2k.co.nz/	NZ/Hardware
Renaissance Apple Computer	http://www.apple.co.nz/	NZ/Hardware
Sun Microsystems NZ	http://www.sun.co.nz	NZ/Hardware
Arbor	http://www.arbor.com.tw/main.htm	TW/Hardware
Flytech Technology	http://www.flytech.com.tw	TW/Hardware
LEO System	http://leosys.com/	TW/Hardware
MITAC Corporation	http://www.mitac.mic.com.tw/	TW/Hardware

APPENDIX B

Table B1. Evaluation Instrument

	Column 1	Column2	Column 3	Column 4			
	Web functions	Where?	Activity	C.1	C.2.1	C.2.2	C.3
Information	1.1 Company Overview (about us)		To find the information which introduces the company. (then use criteria form 1)				
	1.2 Financial Information (investor information or annual report)		To find the financial information about the company. (then use criteria form 1)				
	1.3 Privacy (privacy policy)		To find the privacy description. (then use criteria form 1)				
	1.4 Product Catalog		To find one product. Is the price shown in the catalog? YES, NO ; Can order? YES (jump to 2.1), NO ; (then use criteria form 1).				
	1.5 New Product Announcement		To find one item of new product. (then use criteria form 1)				
	1.6 News (what's new)		To find one item of news. (then use criteria form 1)				
	1.7 Learning Information		To find the information which provides knowledge to help learning. (then use criteria form 1)				
Negotiation	2.1 Order (Negotiation)		To find the information about how to order the product. (then use criteria form 2)				
Settlement	3.1 Payment		To find the information about how to make payment. (then use criteria form 2)				
	3.2 Monitoring Goods (order status)		To find the information about how to monitor goods. (then use criteria form 2)				
	3.3 Exchange Document		To find the information about how to exchange document. (then use criteria form 2)				
After-sale	4.1 Maintenance (customer support)		To find the information about how to maintain the product. (then use criteria form 1)				
	4.2 Training Information		To find the information about how to train the users of the product. (then use criteria form 1)				
	4.3 FAQ for Customer Support		To find the descriptions of FAQ for customer support. (then use criteria form 1)				

Step 1: Find all the following Web functions in column 1. If it is found on the homepage, place a “√” in Column 2. If not, jump to the next function.

Step 2: Conduct those activities, which have ticked, by clicking its function item. Then, complete Column 4 by using criteria forms 1 and 2. If other functions are found when conducting activities, write a note to describe under what hyperlink item, into Column 2. **If the function is a password protected, then use criteria form 2 to evaluate.**

Step 3: Conduct those activities, which are found during the activities, and then complete Column 4 **(If the function found does not work, it is scored 0 totally).**

Table B2. Criteria form 1

Criterion 1: How easy is it to use the function to find one piece of information?	Criterion 2.2: How useful is the information found?
A- Very easy. B- Easy. C- Not easy. D- Difficult. E- The function could not work.	A- The content of the information is three times the screen. B- The content of the information is two times the screen. C- The content of the information is one screen. D- The content of the information is less than one screen. E- Useless.
Criterion 2.1: How informative is the Web function?	Criterion 3: Describe the function and the information found after conducting the activity.
A- Very informative. The function comprises more than 10 sub-functions. Each sub-function is a hyperlink which links to more specific subjects. B- Informative. The function comprises 5 – 10 sub-functions. Each sub-function is a hyperlink which links to more specific subjects. C- Not very informative. The function comprises 2 – 5 sub-functions. Each sub-function is a hyperlink which links to more specific subjects. D- The function is only an one page presentation. E- Useless.	<p>The function has:</p> A- Search engine: there is a specific search engine provided to search previous information (not the general search function to search the whole Web site) <p>The information found comprises (multiple choice):</p> B- Hyper-links in the text: At least one hyperlink exists in the final text and provides links to other resources. C- Interactive function: e-mail provided at the end of the information, which is used to inquire about information or give feedback. D- Real-time communication function: there is a function providing communication with the service persons directly.

APPENDIX B. CONTINUED

Table B3. Criteria form 2 (for evaluating password-protected functions)

Criterion 1: Is there any helpful instruction provided to guide as to how to use the function?	Criterion 3: Describe the function and the characteristics found on the Web page where the function is located.
<p>A- Yes, much helpful information provided, which has more than 10 Web pages.</p> <p>B- Yes, some helpful information provided, which has 2 – 10 Web pages.</p> <p>C- Yes, a little helpful information provided, which has only one Web page.</p> <p>D- Yes, but only the phone number or e-mail address provided.</p> <p>E- No, there is no information which introduces how to use the function.</p>	<p>The function is (choose A or B):</p> <p>A- The function comprises some information, but it does not provide direct interaction with the company.</p> <p>B- It is a function to interact data with company directly.</p> <p>What characteristics are found on the Web page where the function is located? (multiple choice)</p> <p>C- Phone or fax numbers provided at the end of the information, which is used to inquire about further information.</p> <p>D- E-mail provided at the end of the information, which is used to inquire about information or give feedback.</p> <p>E- Real-time communication function: there is a function providing communication with service persons directly.</p>

APPENDIX B. CONTINUED

Table B4. Scoring systems for each criterion

Criterion in Criteria Form 1				
Level	1 Ease of identification	2.1 Ease of use	2.2 Usefulness of information	3 Interactivity
A	10.0	10.0	10.0	2.0
B	7.5	7.5	7.5	2.0
C	5.0	5.0	5.0	2.0
D	2.5	2.5	2.5	10.0
E	0	0	0	x
Criterion in Criteria Form 2				
Level	1 Helpful	2.1	2.2	3 Interactivity
A	10.0	x	x	2.0
B	7.5	x	x	2.0
C	5.0	x	x	2.0
D	2.5	x	x	2.0
E	0	x	x	10.0