User Satisfaction Using Webqual Instrument:
A Research on Stock Exchange of Thailand (SET)

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ABSTRACT

User satisfaction held an important position in an organization to measure information system implementation excellence. Therefore, it is necessary for an organization to evaluate their delivered service using end-user satisfaction as feedback. The objectives of this study are to evaluate user satisfaction and examine the dimensions of WEBQUAL instrument which are valued by e-library user in Stock Exchange of Thailand (SET). This research conducted under WEBQUAL theory (Barnes and Vidgen) and end-user satisfaction theory (Doll and Torkzadeh). Analysis organized from a set of data which involve 341 responses from e-library systems end-users confirm some degree of positive association between WEBQUAL dimensions and end-user satisfaction.

Keywords: User satisfaction, e-library systems, WEBQUAL theory, end-user satisfaction theory.

INTRODUCTION

The Stock Exchange of Thailand's (SET) library was established in 1975 with the mandate to be an information center for people interested in money matters and the capital markets as well as other related topics. In 2004, to improve the image of a modern library in Thailand, the SET renovated its library's facilities to become a learning center for the new millennium and renamed it the "Maruey Knowledge and Resource Center" (MKRC). The re-styled library's new name, the "Maruey Knowledge and Resource Center", honors Dr. Maruey Phadoongsidhi, the renowned fifth President of the SET whom contributions to the Thai capital market (www.maruey.com).

The vision of the SET's current President, Mr. Kittiratt Na-Ranong, was to create a new-style library environment for the new generation of information seekers. This "new age library" incorporates every form of media so that it can provide the general public with a "one-stop Center" to seek information and spend their leisure time constructively. It's a "learning environment" that provides the benefits of both information and fun. The MKRC has been renovated using the most modern concepts in library design. The Center is well-equipped with the latest in multi-media technology, and its modern style offers its users an extensive array of learning facilities all wrapped up in a spacious, comfortable, welcoming atmosphere. The MKRC's state-of-the-art multi-media equipment permits users to conduct information searches effortlessly, make wireless connections to the Internet, provide (in "the fun zone") access to big screen televisions, movies, breaking news programs, live seminar and an assortment of music (www.maruey.com).

One of the facilities of importance owned by Maruey library is e-library system. As a part of Stock Exchange of Thailand (SET) it is necessary for library management, as an organization, to evaluate every service they deliver to user. This is significant since SET is an important organization in Thailand. Results of the study offer unique insights for management on how to manage the quality of their e-library system. One of the important things that the library can evaluate is user satisfaction. The library user whether member or non-member who are using the library systems eligible to be the evaluator. The e-library is one of service' element provide by Maruey library. E-library became important because it acts as a gateway to all of the electronic resources owned by library. These resources contain digital data such as full text of a journal, financial online database or any web based resources.

Several research conducted with user satisfaction in information systems, start from the pioneer Bailey and Pearson, Ives, et.,al and also Doll and Torkzadeh. They develop the approach to measure user satisfaction for information systems or computer system. Bailey and Pearson was the first researcher who introduce instrument to measure user satisfaction in 1983. They had opinion that a definition of user satisfaction should contain a complete and valid set of factors and an instrument which measures not only the user's reaction to each

factor but also why the respondent acted as they did. Ives et al, define user satisfaction as the extent to which users believe the information system available to them meets their information requirements, while Doll and Torkzadeh are of the opinion that systems that better meet information requirements of the user and are more easy to use will have more satisfied users (Gelderman, 1998). Many researcher conducts with their approach when the researcher want to observe user satisfaction (Hartrum, 2004). Beside the pioneer, there are several instrument has been developed the quality of e-commerce service. They are EtailQ, developed by Wolfinbarger and Gilly (2003). This scale includes 14 items divided into 4 dimensions (design, customer service, reliability/compliance with commitments and security/privacy); WEBQUAL developed by Barnes & Vidgen, composed of 22 items on 3 dimensions (usability, information quality and service interaction quality). Sitequal developed by Yoo and Donthu (2001), including 9 items distributed over 4 dimensions (ease of use, design, processing speed and security). Since there are several instruments that describe qualities of e-commerce services, it's interesting to observe one of them in this research. The most interesting by research judgment is WEBQUAL, because it has been developed now until version 4.0. The things that interesting to observe is about the quality of e-commerce and user satisfaction. In this research the quality of the e-commerce will use WEBQUAL instrument version 4.0. The explanation for choosing WEBQUAL in this research will be explained further in another section. According to the background and the explanation, this research has statement of problem: 1) *Is it correct that the dimension of WEBQUAL which are usability, information quality and service interaction quality associate with user satisfaction?*, 2) *How is user satisfaction in e-library systems of SET? And* 3) *How is the model to predict user satisfaction in e-library system of SET?*

User satisfaction is important for organization because user satisfaction is a key success to measure of information system implementation. If the result can't satisfy the user, that will make the point of weakness or failed system. Otherwise, it means that the system should not be used or improvised later. That's why user satisfaction is the main important criteria to measure the performance of e-library system. Yeo (2002) said that high user satisfaction with a system leads to greater system usage, because user satisfaction is one commonly acknowledge factor in the successful implementation of any application or information systems. Zviran (2005) also said user satisfaction is a critical construct because it is related to other

important variables in systems analysis and design. In another words Delone and McLean (cited in Cai et al, 2007) said measuring user satisfaction is regarded as one of the most popular approaches in assessing the success of IS because of the following three reasons: utilizing satisfaction as a success measure makes common sense; reliable tools are available to measure satisfaction; and other measures seem to be not easy to acquire. According to above explanation, it's very reasonable as an organization to evaluate user satisfaction in every service they deliver. Results of the study offer unique insights for management on how to manage the quality of their e-library system. E-library system in this context is library website own by Stock Exchange of Thailand (www.maruey.com).

WEBQUAL THEORY

Researcher conducted with literature review from some of previous research. The list of literature review showed on table 1 which also discussed further in this part. The objective of this part is to find the appropriate research methodology in this research. The main theory that will use in this research is WEBQUAL theory. WEBQUAL is a method or instrument for assessing the quality of an organization's e-commerce offering using user's perceptions. This instrument is being developed by Richard Vidgen from Management Schools at the University of Bath and Stuart Barnes from School of Information Management at Victory University of Wellington (www.WEBQUAL.co.uk). The WEBQUAL Index gives an overall rating of an e-commerce Web site that is based on customer perceptions. WEBQUAL instrument has been developed iteratively through application in various domains, including internet bookstores and internet auction sites. Those research was conducted by Barnes, S., and Vidgen, R., (2001, 2002, 2003, 2005) and also Barnes, S. J., K. Liu, and R. T. Vidgen (2001). This instrument can also used to conduct with general website, such as library. The adjustment make from the question that ask in questionnaire. WEBQUAL 4.0 has 22 questions, but for this research we just eliminate and make adjustment into 18 questions. This research eliminated or changed the question that not related with e-library context, such as online payment systems. Since this research is not conducted with e-commerce payment, this research will omit the questions that are conducted with e-commerce payment. Measurement of user satisfaction will use the questions from two global satisfaction criteria, which will be explained more in user satisfaction section.

Table 1. Literature Review

NO	AUTHOR NAME; TITLE/ TOPIC & YEAR	SAMPLE SIZE & SAMPLING TECHNIQUE	PROBLEM STATEMENT/ OBJECTIVE	STATISTICAL ANALYSIS
1	Barnes, Stuart J and Vidgen, Richard T (2001), Assessing the Quality of Auction Web Sites	39 students, convenience technique (non probability sampling)	To assess the validity of the WebQual instrument and supplemented by qualitative data that is used to consider the relative merits of the three sites evaluated.	Levene's test for equality of variances and a t-test for differences in means.
2	Nikos, Tsikriktsis (2002), Does Culture Influence Website Quality Expectation?	171 MBA students from London Business School	To assess the association between the dimensions of culture and website quality	Multiple regression
3	Barnes, S., and Vidgen, R., (2005), Data Triangulation in action: using comment analysis to refine web quality metrics	420 respondent, using random technique	To evaluate quality perception from user	ANOVA
4	Barnes, S. J., K. Liu, and R. T. Vidgen, Evaluating WAP News Sites: the WebQual/M approach	32 respondent	Evaluate of wireless internet news sites	Cronbach
5	Loiacono, Eleanor et al (2002), WebQual Revisited: Predicting The Intent to Reuse a Website.	646 respondent, student university	To identify the higher level latent variables that influence consumer's intention to reuse a web	Multiple regression
6	Zviran, Moshe et al (2005), User Satisfaction from Commercial Website: the effect of design and use	359 respondent	To assess user based design and usability on user satisfaction	F test and t test.
7	Barnes, S., & Vidgen, R., (2002), An integrative approach to the assessment of e-commerce quality	376 respondent	Assess the quality of internet bookstore' website using webqual 4.0	Variety statistical analysis
8	Yeo, Julia et al (2002), When Technology is Mandatory-Factors Influencing Users Satisfaction	250 respondent from undergraduate student who attending an introductory database course	To assess factors that influence user satisfaction	Least square linear regression and ANOVA test
9	Xiao, Li and Dasgupta, Subhasish (2002), Measurement of User Satisfaction with Web-Based Information Systems: An Empirical Study, Eight Americas Conference on Information Systems.	340 respondent from Mid-Atlantic University' student	To develop and validate an instrument for measuring user satisfaction in a web-based environment	Total-correlation

There is a debate for which instrument is better used when researcher conduct with website assessment. Voss said WEBQUAL went a step further for website quality (Nikos, 2002). A comparison of WEBQUAL with SERVQUAL based on the insights provided by Voss (cited in Nikos, 2002) leads to the following observations: First, reliability (which, according to Voss, includes the ability to connect to the Web, downtime, systems not crashing, and order fulfillment) is not really good addressed by WEBQUAL. One could actually say that WEBQUAL considers reliability to be a given, or in other words, a precondition for a good Web site. In WEBQUAL perception, reliability dimension has been covered by three dimensions in version 4.0. Second, responsiveness is addressed by both SERVQUAL and WEBQUAL. Third, what is defined as assurance by SERVQUAL is captured by the notion of trust by WEBQUAL. Fourth, empathy translates into flow emotional appeal in WEBQUAL. Finally, tangibles are captured by design appeal and visual appeal in WEBQUAL (Nikos 2002). Further, Loiacono (2002) also said WEBQUAL is a comprehensive website quality measurement. Pitt et al (1997), said WEBQUAL and SERVQUAL has a different angle, which

SERVQUAL focus on Information Systems (IS) service quality whether WEBQUAL focus on website quality (Barnes, 2001). Pitt et al, conclude that "No good canvas is completed in a single attempt". Zviran (2005) also said the same things, that WEBQUAL 4.0 is a popular index calculated on the basis of user perception with three dimensions.

According to the explanation, the most interesting concept by research judgment is WEBQUAL, because it has been developed until version 4.0. This shows WEBQUAL doesn't focus on just information systems area but also specify in assess website quality from the first version. SERVQUAL began the concept from customer service concept in marketing area. Table 2 shows that the provenance of WEBQUAL 4.0, which is the source of the dimension, came from many resources that is related with IS assessment. It means the development of WEBQUAL 4.0 came from strong foundation of many IS assessment, such SERVQUAL developed by Parasuraman or User Satisfaction model by Bailey.

Table 2: The provenance of WEBQUAL 4.0

Category	WebQual 4.0 Questions	Illustrative Support for Questions
Usability	1. I find the site easy to learn to operate	Bailey and Pearson 1983[2], Davis et al. 1989[2], Davis 1989[2], 1993[1], Ventakesh and Davis 2000[2]
	2. My interaction with the site is clear and understandable	Davis et al. 1989[2], Davis 1989[2], 1993[1], Shneiderman 1998[2], Ventakesh and Davis 2000[2]
	3. I find the site easy to navigate	Eighmey 1997[2], Levi and Conrad 1996[2], Nielsen 1999[2], 2000a[2], Spool 1999[2]
	4. I find the site easy to use	Davis et al. 1989[2], Davis 1989[2], 1993[1], Ventakesh and Davis 2000[2], Nielsen 1993[2], 1999[2], 2000a[2]
	5. The site has an attractive appearance	Nielsen 2000a[2], Parasuraman et al. 1988[1], 1991[2], Pitt et al. 1995[2], 1997[2]
	6. The design is appropriate to the type of site	From WebQual workshops; no strong support, but tangential to research on customer expectations of appearance, e.g. Zeithaml et al. 1990
	7. The site conveys a sense of competency	Parasuraman et al. 1988[1], 1991[2], Pitt et al. 1995[2], 1997[2], Zeithaml et al. 1988[2], 1990[2], 1993[2]
	8. The site creates a positive experience for me	Eighmey 1997[2], Moon and Kim 2001[2], Nielsen 2000a[2], White and Manning 1998[2]
Information	9. Provides accurate information	Bailey and Pearson 1983[2], Strong et al. 1997[2], Wang 1998[2], Wang and Strong 1996[1], Wand and Wang 1996[2]
	10. Provides believable information	Strong et al. 1997[2], Wang 1998[2], Wang and Strong 1996[1], Wand and Wang 1996[2]
	11. Provides timely information	Bailey and Pearson 1983[2], Strong et al. 1997[2], Wang 1998[2], Wang and Strong 1996[1], Wand and Wang 1996[2]
	12. Provides relevant information	Bailey and Pearson 1983[2], Strong et al. 1997[2], Wang 1998[2], Wang and Strong 1996[1], Wand and Wang 1996[2]
	13. Provides easy to understand information	Bailey and Pearson 1983[2], Strong et al. 1997[2], Wang 1998[2], Wang and Strong 1996[1], Wand and Wang 1996[2]
	14. Provides information at the right level of detail	Bailey and Pearson 1983[2], Strong et al. 1997[2], Wang 1998[2], Wang and Strong 1996[1], Wand and Wang 1996[2]
	15. Presents the information in an appropriate format	Bailey and Pearson 1983[1], Chau et al. 2000[2], DeLone and McLean, 1992[2]
Service Interaction	16. Has a good reputation	Aaker 1991[2], Aaker and Joachimsthaler 2000[2], Akshay and Monroe 1957[2], Cuningham 1966[2], Nielsen 1999[2]
	17 It feels safe to complete transactions	Parasuraman et al. 1988[1], 1991[2], Pitt et al. 1995[2], 1997[2], Zeithaml et al. 1988[2], 1990[2], 1993[2]
	18. My personal information feels secure	Clark 1999[2], Cranor 1999[2], Goodwin 1991[2], Hoffman et al. 1999[2], Wang et al. 1998[2]
	19. Creates a sense of personalization	Gilmore and Pine 2000[2], McKenna 2000[2], Parasuraman et al. 1988[1], 1991[2], Pitt et al. 1995[2], 1997[2], Schubert and Selz 1997[2], Zeithaml et al. 1988[2], 1990[2], 1993[2,]
	20. Conveys a sense of community	Armstrong and Hagel 1996[2], Chang et al. 1998[2], Hagel and Armstrong 1997[2], Preece 2000[2], Rheingold 1993[2], Schubert and Selz 1997[2]
	21. Makes it easy to communicate with the organization	Bitner et al. 2000[2], Jarvenpaa et al. 2000[2], Hoffman et al. 1999[2], Nielsen 2000a[2]
	22. I feel confident that goods/services will be delivered as promised	Parasuraman et al. 1988[1], 1991[2], Pitt et al. 1995[2], 1997[2], Zeithaml et al. 1988[2], 1990[2], 1993[2]

[1] denotes a primary source for a question - reworded for WebQual 4.0
[2] denotes a secondary influence for the inclusion of a question in WebQual 4.0

Source: Barnes and Vidgen (2005)

The Milestone of WEBQUAL

The first version of the WEBQUAL instrument (WEBQUAL 1.0) was developed in part from the results of a quality workshop held with students who were asked to consider the qualities of an excellent business school web site. The WEBQUAL instrument was refined through a process of iterative refinement using pilot questionnaires before being released to a larger population. The 24-question instrument was tested by application in the domain of UK business school web sites. Analysis of the collected data led to the removal of one question. Based on reliability analysis, the remaining 23 questions were clustered into four major dimensions: ease of use, experience, information, and communication and integration (Barnes & Vidgen, 2001).

The qualities identified in WEBQUAL 1.0 formed the starting point for assessing web site information quality in WEBQUAL 2.0. However, in applying WEBQUAL to B2C web sites it became clear that the interaction perspective of quality was largely missing from WEBQUAL 1.0. The work on service quality, notably SERVQUAL, was used to augment the information quality aspect of WEBQUAL with interaction quality. Service quality is commonly defined by how well a service level delivered matches customer expectations. The development of WEBQUAL 2.0 required some significant changes to the WEBQUAL 1.0 instrument. In order to extend the model for interaction quality, Barnes and Vidgen conducted an analysis of the SERVQUAL instrument in the context of EC web sites and made a detailed comparison of SERVQUAL and WEBQUAL 1.0. This review allowed redundant questions and areas of overlaps to be removed with the result that most of the key questions in SERVQUAL were incorporated in WEBQUAL 2.0, whilst keeping the instrument to 24 questions (Barnes & Vidgen, 2001).

While WEBQUAL 1.0 was strong on information quality, it was less strong on service interaction. Similarly, where WEBQUAL 2.0 emphasized interaction quality it lost some of the information quality richness of WEBQUAL 1.0. Both versions contained a range of qualities concerned with the Web site as a software artifact. In reviewing the instruments Barnes and Vidgen found that all of the qualities could be categorized into three distinct areas: site quality, information quality, and service interaction quality. The new version of WEBQUAL (3.0) was tested in the domain of online auctions (Barnes and Vidgen, 2001).

Analysis of the results of WEBQUAL 3.0 led to the identification of three dimensions of e-commerce Web site quality: usability, information quality, and service interaction quality. Usability is the quality associated with site design, for example appearance, ease of use, navigation and the image conveyed to the user. Information quality is the quality of the content of the site, the suitability of the information for the user purposes such as accuracy, format and relevancy. Service interaction quality is quality of the service interaction experienced by users as they delve deeper into the site, embodied by trust and empathy, for example issues of transaction and information security, product delivery, personalization and communication with the site owner (Barnes & Vidgen, 2002). Usability has replaced site quality in WEBQUAL version 4.0 because it keeps the emphasis on the user and their perceptions rather than on the designer and the site as simply a context-free software artefact. The term usability also reflects better on the level of abstraction of the other two dimensions of WEBQUAL - information and service interaction. Barnes and Vidgen (2002) said that the usability dimension draws from literature in the field of human computer interaction with author Davis (1989, 1993; cited in Barnes and Vidgen, 2002) and Nielsen (1993; cited in Barnes and Vidgen, 2002) and more latterly Web usability by Nielsen (1999, 2000; cited in Barnes and Vidgen, 2002) and also Spool et al. (1999; cited in Barnes and Vidgen, 2002). Usability is concerned with the pragmatics of how a user perceives and interacts with a Web site: is it easy to navigate? Is the design appropriate to the type of site? It is not, in the first instance, concerned with design principles such as the use of frames or the percentage of white space, although these are concerns for the Web site designer who is charged with improving usability (Barnes & Vidgen, 2002).
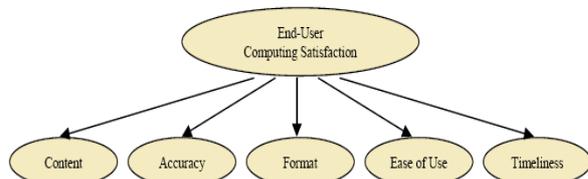
User Satisfaction

Customer satisfaction is a common terminology used in business. In context Information Systems (IS) environment, IS professional used "user satisfaction" in order to evaluate the performance the specific of IS applications. In information systems, user satisfaction is considered to be a key construct for assessing system performance. In view of its applicability to practical environments, user satisfaction is also used by IS professionals in evaluating the performance of specific information system applications or the overall information system in an organization (Barki, 1990; Nikos 2002).

Since information systems are products with observable and measurable characteristics, it is reasonable to expect a similarly strong association to exist between perceived system performance and users' feelings of satisfaction with that performance (Barki, 1990). This concept developed by Bailey and Pearson as a pioneer in user satisfaction research, which said user are satisfied or not, depends on the balance between user' expectation and user' experience with the services (Barki, 1990).

Ives et al in 1983 developed a User Information Satisfaction (UIS) instrument to measure user's general satisfaction with the information provided by the data processing group of the organization. Limitations of the study included use of an instrument that was based on the data processing computing environment. The emphasis was on computing tasks that were carried out by the data processing group in an organization. The measuring scale was semantic differential rather than Likert-scale type scaling. Due to the limitations of this study, this instrument is not used as much as the EUCS instrument developed by Doll and Torkzadeh (Xiao, 2002).

Doll and Torkzadeh developed a 12-item EUCS instrument by contrasting traditional data processing environment and end-user computing environment, which comprised of 5 components: content, accuracy, format, ease of use, and timeliness (Xiao, 2002). Their instrument was regarded as comprehensive, because they reviewed previous work on user satisfaction in their search for a comprehensive list of items. The construct was developed with a five point Likert-type scale 1 = almost never; 2 = some of the time; 3 = about half of the time; 4 = most of the time; and 5 = almost always (Xiao, 2002).

Source: Xiao and Dasgupta (2002)

Figure 1. End-User Computing Satisfaction (EUCS) Instruments
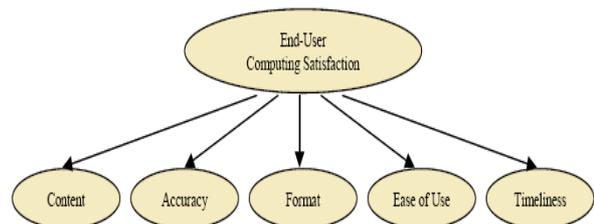
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Source: Xiao and Dasgupta (2002)

Figure 1. End-User Computing Satisfaction (EUCS) Instruments

Study conduct by Xiao (2002), develop and validate an instrument to measure user satisfaction in the information age. They adopt the EUCS (End-User Computing Satisfaction) instrument by Doll and Torkzadeh and then checked whether this existing instrument could be used in the new information systems environment. They research based on the assumption there are differences between web-based information systems and traditional corporate information systems. For example, with wide spread use of Internet, access to web-based information systems as well as information has been significantly enhanced. In addition, web-based information systems become more complicated than traditional information systems. More issues other than content, accuracy, format, ease of use and timeliness may be relevant and important in measuring user satisfaction with them. Because of differences between web-based information systems and traditional information systems, it is not appropriate to adopt the EUCS instrument to measure user satisfaction with web-based information systems without examining validity and reliability of the instrument in the specific environment (Xiao, 2002). They research found that significant progress towards keeping the End-User Computing Satisfaction (EUCS) as relevant instrument and applicable under the computing environment of information era or web based information systems.

However this research will not use the concept from Bailey or Ives et al to measure user satisfaction. The researcher use EUCS instrument from Doll and Torkzadeh. Xiao and Dasgupta (2002), mention that EUCS instrument is a widely used and has been validated through several confirmatory analyses and construct validity tests. Further, they also mention that after the exploratory study was completed in 1988, two confirmatory studies with different samples were conducted respectively in 1994 and 1997, which suggested the instrument was valid. A test-retest of reliability of the instrument was conducted in 1991, indicating the instrument was reliable over time (Xiao 2002). The instrument is widely accepted and adopted in other researches. Further, Xiao (2002) said that McHaney and Cronan (1998, 2000) adopted it to examining computer simulation success. Another researcher that conducted are McHaney et al (1999) adopted it in decision support systems research, also Chen et al. (2000) applied it to measure user satisfaction with data warehouse (Xiao 2002).

RESEARCH METHODOLOGY

According to WEBQUAL theory, there are usability, information quality and service interaction as the dimension that represents good quality from a website. A user's perception of a "good" information system would be a system where a user is satisfied with the qualities of the website. These qualities represent in three dimensions from WEBQUAL version 4.0. The previous researches suggest the dimensions of WEBQUAL are predictive of user satisfaction and the intention of user to reuse the website (Barnes, 2002; Loiacono, 2002). WEBQUAL is based on quality function deployment (QFD) - a "structured and disciplined process that provides a means to identify and carry the voice of the customer through each stage of product and or service development and implementation". Applications of QFD start with capturing the 'voice of the customer'- the articulation of quality requirements using words that are meaningful to the customer. These qualities are then feed back to customer and form the basis of an evaluation of the quality of a product or service (Barnes, 2001).

Two global satisfaction criteria will used to measure end-user satisfaction regarding to WEBQUAL dimension. These measurements developed by Doll and Torkzadeh. Already mention before, the measurement by Doll and Torkzades had been tested by many researchers. This research adopts the two global satisfaction criteria from Doll and Torkzadeh but not for the Information System (IS) qualities criteria, since the qualities offer from WEBQUAL version 4.0 is more appropriate for e-library assessment.

The picture below, presents the conceptual illustrating effects of e-library quality on user satisfaction. The conceptual depicts the quality dimension of e-library systems can drive the level of user satisfaction. The picture shows that the research examines the association of each dimension with user satisfaction. In another words, this study examine the association 18 item as e-library quality with two global end-user satisfaction criteria. The conceptual model in this research develops from WEBQUAL theory by Barnes & Vidgen (2001, 2002, 2003, 2005) and also end-user satisfaction theory by Doll and Torkzadeh (Xiao, 2002).
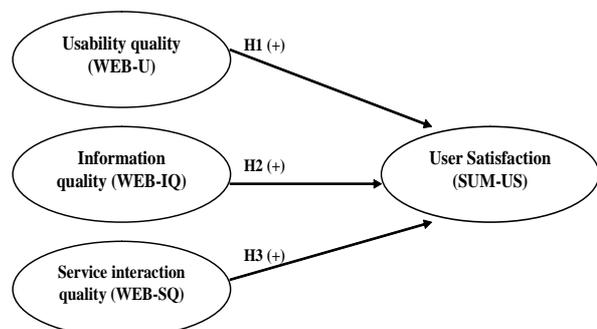

Figure 2: Conceptual model for user satisfaction using WEBQUAL

Based on the conceptual model, this research has the hypotheses:

H1 : There will be positive association between usability (WEB-U) and user satisfaction.

H2 : There will be positive association between information quality (WEB-IQ) and user satisfaction.

H3 : There will be positive association between service interaction quality (WEB-SQ) and user satisfaction.

These hypotheses were developed based on the theory of WEBQUAL. In the previous part already mentioned, the theory has 3 quality dimensions that affect user satisfaction regarding system based-on web. These qualities are Usability Quality (WEB-U), Information Quality (WEB-IQ) and Service Interaction Quality (WEB-SQ). These hypotheses synchronize with the objective of this research which is to examine WEBQUAL dimension with user satisfaction in Stock Exchange of Thailand (SET).

The population of this research is all library visitors who are using e-library systems. According to library' webmaster, there are ± 3000 visitors who using the website every month. Collection of data starts from May 3, 2008 until May 8, 2008. According to Krejcie and Morgan (1970) 341 sample sizes is eligible to use when the research is conducted on 3000 populations. Collection data will conducted by distributing the questionnaires to library visitors who uses e-library system during that time.

Churchill describes the need to purify the instrument before going beyond the research. Further according to Cronbach and Churchill, purifying the instrument with factor analysis, calculate the coefficient alpha and item-to-total correlations, will be used to delete garbage items (Wang et al, 2001).

According to framework thinking which have been elaborated at previous point, this research examines the association between WEBQUAL dimension and user satisfaction through four variables. There are three independent variables in this research, which are usability, information quality and service interaction quality. Beside that, this research also has one dependent variable, which is user satisfaction. The measurement scale use in this research is seven-point Likert scale. Users will asked to rate the site for each quality using a scale ranging from 1 (strongly disagree) to 7 (strongly agree). Beside Likert scale measurement, open comments are also encouraged. The questionnaire in this research is divided into three qualities measurements, which are usability, information quality and interaction quality. User satisfaction measures by two global end-user satisfaction criteria according to Doll and Torkzadeh procedure (Xiao, 2002).

Table 3. variable, nominal definition and operationalize definition

VARIABLE	NOMINAL DEFINITION	OPERATIONALIZE DEFINITION
Usability	Qualities associated with site design and usability; for example, appearance, ease of use and navigation and the image conveyed to the user (www.WEBQUAL.co.uk)	‣ The degree of easy to learn ‣ The degree of easy to operate ‣ Has an attractive appearance ‣ Appropriate to the type of site ‣ Conveys a sense of competency ‣ Create a positive experience
Information quality	The quality of the content of the site: the suitability of the information for the user's purposes, e.g. accuracy, format and relevancy (www.WEBQUAL.co.uk)	‣ Provides accurate information ‣ Provides believable information ‣ Provides timely information ‣ Provides relevant information ‣ Provides easy to understand information ‣ Provides information at the right level of detail ‣ Presents the information in an appropriate format
Service interaction quality	The quality of the service interaction experienced by users as they delve deeper into the site, embodied by trust and empathy.(www.WEBQUAL.co.uk)	‣ Has a good reputation ‣ Secure the personal information ‣ Creates a sense of personalization ‣ Conveys a sense of community ‣ Makes it easy to communicate with the management or customer service
User satisfaction	The opinion/ perception of the user about a specific factors from computer application (Doll and Torkzadeh; from wikipedia website)	The perception of user about: ‣ The successful of the system ‣ Their satisfaction (Doll and Torkzadeh; from Zviran, 2005)

Data Analysis Technique

The researcher collected 341 the questionnaires that are filled-out completely by the respondents. This research uses SPSS software (v. 12) to analyze the data. In this study the researcher followed the methodology used by Doll - Torkzadeh and also Xiao-Dasgupta to analyze the data (Xiao, 2002). The researcher analyzed the construct validity and reliability. This was done with factor analysis, item-total correlation and *Cronbach's alpha (α)* testing. After researcher conduct with preliminary analysis, researcher will use multiple regressions to analyze the data.

In statistical view, there are two types of variables association, dependent and independent variables. This research has three independent variables, which are usability, information quality and service interaction quality. Whether for dependent variable the research has user satisfaction. Since in this research responses to all Likert questions will be summed, data for this research will treat as interval data measuring a latent variable. In this case parametric statistical tests that appropriate are the analysis of variance (ANOVA), multiple regression or structural equation modeling (SEM).

This research has objective study to examine association between independent variable and dependent variable, examine the association of each dimension from WEBQUAL version 4.0 with user satisfaction. According to George (2003) and Andy (2000), bivariate correlation or Pearson correlation (r) is appropriate to use to examine relationship or association between two variables. Multiple regression analyses or structural equation modeling (SEM) is used when the research conduct with multivariate research or more than two variables. Since this research using three independent variables and one dependent variable, SEM and multiple regression analyses appropriate to examine the association. Structural equation modeling is a statistical technique for testing and estimating causal relationships using a combination of statistical data and qualitative causal assumptions. In SEM, the qualitative causal assumptions are represented by the missing variables in each equation, as well as vanishing covariance among some error terms. These assumptions are testable in experimental studies and must be confirmed judgmentally in observational studies.

Since SEM is advance research and irrelevant to the objective of this research, the researcher concludes that better to use multiple regressions, same with the research conduct by Nikos (2002) and Loiacono (2002). Multiple regression analysis in this research used to investigate whether each WEBQUAL dimension is associated with user satisfaction. The model for this research shown below:

$$SUM\text{-}US = a + b.WEB\text{-}U + c.WEB\text{-}IQ + d.WEB\text{-}SQ$$

a	= constant for regression
b, c, d	= coefficient from independent variable
WEB-U	= usability dimension
WEB-IQ	= information quality dimension
WEB-SQ	= service interaction quality dimension
SUM-US	= end user satisfaction

In conducting the factor analysis, the researcher expected the factors (question in questionnaire) to load on the constructs originally identified by the earlier study. A principal component matrix analysis with a VARIMAX rotation was employed in this research. There are 18-item questions in this study, excluded the two-item score of global satisfaction. As Doll and Torkzadeh, this study assumed that the two global measures of end-user satisfaction to be valid (Xiao, 2002). This study took the threshold value of 0.5 for factor loading criterion.

Table 4 shows Q15 ("My personal information feels secure") below 0.5 (the value not displayed because below 0.5). According to researcher observation, it is not difficult to see why that item has value below 0.5. It is related with the menu from the website. From library' website there is just one point that user must enter their personal information, when they want to communicate with library management. User rarely use this menu, because when they want to make communication with library' management they can directly contact the reception. This is possible because most of the website visitor access the website from the library. The result from the first factor analysis, researcher dropped item Q15. After deleting these items, researcher conducted factor analysis again. Therefore the end result of factor analysis keeps a 17-item instrument.

Table 4. Rotated component matrix

	Component		
	1	2	3
d-accurateinfo(Q7)	,826		
d-timely(Q9)	,813		
d-believe(Q8)	,812		
d-detail(Q12)	,798		
d-understand(Q11)	,763		
d-relevant(Q10)	,761		
d-format(Q13)	,704		
d-easylearn(Q1)	,634	,555	
d-easyoperate(Q2)	,610	,599	
d-experience(Q6)		,700	
d-attractive(Q3)		,678	
d-competency(Q5)		,644	
d-reputation(Q14)		,612	
d-design(Q4)		,589	
d-secure(Q15)			
d-community(Q17)			,790
d-communicate(Q18)			,722
d-personalize(Q16)			,710

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 7 iterations.

Source: SPSS Output v.12

Following Doll-Torkzadeh procedure (Xiao, 2002), researcher examined the correlation of score of each item with the total score of all question. Table 5 lists the result of correlation assessment. According to Doll and Torkzadeh, there is no accepted standard of cutoff threshold; therefore this study took the same cutoff value of 0.5 as they did in their study.

Table 5. Item-total correlation

Factor	Correlation Coefficient	Alpha
d-easylearn(Q1)	0.788	<.0001
d-easyoperate(Q2)	0.796	<.0001
d-attractive(Q3)	0.659	<.0001
d-design(Q4)	0.699	<.0001
d-competency(Q5)	0.781	<.0001
d-experience(Q6)	0.703	<.0001
d-accurateinfo(Q7)	0.723	<.0001
d-believe(Q8)	0.713	<.0001
d-timely(Q9)	0.729	<.0001
d-relevant(Q10)	0.764	<.0001
d-understand(Q11)	0.751	<.0001
d-detail(Q12)	0.720	<.0001
d-format(Q13)	0.713	<.0001
d-reputation(Q14)	0.367	<.0001
d-personalize(Q16)	0.517	<.0001
d-community(Q17)	0.528	<.0001
d-communicate(Q18)	0.581	<.0001

Source: SPSS Output v.12

As table 5 shown, all item coefficients are above the threshold of 0.5, except for the question Q14 "The website has a good reputation".

This measurement (α) is the most widely used in research (George, 2003). Coefficient alpha is designed as a measure of the internal consistency; that is, do all items within the instrument measure the same things? Alpha is measured on the same scale as a Pearson *r* (correlation coefficient) and typically varies between 0 and 1. The closer the alpha is to 1.00, the greater the internal consistency of items in the instrument being assessed. According to George (2003), there is a rule of thumb that applies to most situations regarding to alpha value; α > 0.9 – excellent; α > 0.8 – good; α > 0.7 – acceptable; α > 0.6 – questionable; α > 0.5 – poor; α < 0.5 – unacceptable.

The 16-item (two dropped) instrument had reliability 0.929, exceeding the minimum standard of 0.8 suggested for basic research (Wang et al, 2001). Actually most of these 16-items had value above 0.7. Two item, which Q16 ("Website create a sense of personalization") and Q17 ("Conveys a sense of community") had a value around 0.4. Doll-Torkzadeh use cut-off value 0.4 for reliability analysis.

FINDING AND RESEARCH RESULTS

In order to test the influences of the three independent variables and end-user satisfaction, the researcher performed a linear regression analysis, entering the end user overall satisfaction as a dependent variable, and the website quality as independent variables. In this analysis, the studies conduct with 16-item questions and 2-item global criteria end-user satisfaction.

From descriptive statistics, it looks that the average of satisfaction close to scale-five, it means close to "somewhat agree" that the website satisfied the end-user. Actually this table isn't necessary for interpreting the regression model, but it is a useful summary of the data.

Table 6. Descriptive statistics

	Mean	Std. Deviation	N
SUM_US	4,8196	,92698	341
WEB_U	4,9022	,91308	341
WEB_IQ	5,0221	,88820	341
WEB_SQ	4,2199	,99090	341

In addition to the descriptive statistics, selecting this option produces a correlation matrix too. Table 7 below shows three things: 1) The table shows the value of the Pearson correlation coefficient between every pair of variables. For example, the data shows that WEB_U (usability dimension) had a large positive correlation with SUM_US (end-user satisfaction), 2) The one-tailed significance of each correlation is displayed. The correlation above is significant, *p* < 0.001 AND 3) The number of respondent contributing to each correlation is shown, N=341.

Table 7. Correlation table

		SUM_US	WEB_U	WEB_IQ	WEB_SQ
Pearson Correl:	SUM_U	1,000	,677	,603	,552
	WEB_U	,677	1,000	,722	,499
	WEB_IQ	,603	,722	1,000	,405
	WEB_S	,552	,499	,405	1,000
Sig. (1-tailed)	SUM_U	.	,000	,000	,000
	WEB_U	,000	.	,000	,000
	WEB_IQ	,000	,000	.	,000
	WEB_S	,000	,000	,000	.
N	SUM_U	341	341	341	341
	WEB_U	341	341	341	341
	WEB_IQ	341	341	341	341
	WEB_S	341	341	341	341

Table 8. Model Summary

| | | | Adjusted | Std. Error of | Change Statistics | | | | | Durbin- |
Model	R	R Square	R Square	the Estimate	R Square Change	F Change	df1	df2	Sig. F Change	Watson
1	,677[a]	,459	,457	,68301	,459	287,271	1	339	,000	
2	,735[b]	,541	,537	,63085	,082	30,188	2	337	,000	1,995

a. Predictors: (Constant), WEB_U

b. Predictors: (Constant), WEB_U, WEB_SQ, WEB_IQ

c. Dependent Variable: SUM_US

Source: SPSS Output v.12

Table 9. ANOVA Output

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	134,013	1	134,013	287,271	,000[a]
	Residual	158,145	339	,467		
	Total	292,158	340			
2	Regression	158,042	3	52,681	132,372	,000[b]
	Residual	134,117	337	,398		
	Total	292,158	340			

a. Predictors: (Constant), WEB_U

b. Predictors: (Constant), WEB_U, WEB_SQ, WEB_IQ

c. Dependent Variable: SUM_US

Source: SPSS Output v.12

The multiple R shows a substantial association between the three independent variables and the dependent variable SUM_US ($R = .735$). The R-square value on table 8 (model 2) indicates that about 54% of the variance in SUM_US is explained by the three independent variables. This means 46% of the variance in end-user satisfaction cannot be explained by WEBQUAL dimension alone. Therefore there must be other variables that have an influence as well. The "adjusted R-square" gives some ideas of how well the model for generalization. In this research the difference for the final model is small, in fact the difference between the values is 0.541 - 0.537 = 0.004 (about 0.4%). This shrinkage means that if the model were derived from the population rather than a sample it would account for approximately 0.4% less variance in the outcome. Model 1 just wants to predict the influence of usability dimension. It means when only usability dimension used as a predictor (independent variable) it influence the user satisfaction around 45%.

Durbin-Watson test statistic (table 8) useful to test for associations between errors. Specifically, it tests whether adjacent residuals are associated. In short this test is important for testing whether the assumption of independent errors is tenable. As a very conservative rule of thumb, values less than 1 or greater than 3 are definitely cause for concern. According to Andy (2000), the closer to 2 that the value is, the better, and for this research the value is 1.995.

Output ANOVA test whether the model results in a significantly good degree of prediction of the outcome variable. The most important from above table is the F-ratio and the correlated significance value of that F-ratio. This research results significant at $p < 0.001$. Therefore can conclude that the regression model from this research in significantly better prediction of end-user satisfaction than if we used the mean value of end-user satisfaction. In short, the regression model overall predicts end-user satisfaction significantly well. That's why ANOVA use to test whether the model from regression is significantly better at predicting the outcome than using the mean as a 'best guess' (Andy, 2000).

According to research model (2), can formulate the equation shows below:

$$SUM\text{-}US = a + b.WEB\_U + c.WEB\_IQ + d.WEB\_SQ$$
$$= 0.701 + 0.394WEB\_U + 0.221WEB\_IQ + 0.255WEB\_SQ$$

Table 10. Model Parameter

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1,449	,202		7,163	,000
	WEB_U	,688	,041	,677	16,949	,000
2	(Constant)	,701	,214		3,279	,001
	WEB_U	,394	,057	,388	6,882	,000
	WEB_IQ	,221	,056	,212	3,964	,000
	WEB_SQ	,255	,040	,272	6,370	,000

a Dependent Variable: SUM_US

Source: SPSS Output v.12

The β value indicate that relative influence of the entered variable, that is, WEB_U (usability dimension) has the greatest influence on end-user satisfaction (Beta = .0.394), followed by WEB_SQ (service interaction quality dimension) and then WEB_IQ (information quality dimension).

t-test use to measures of whether the independent variables is making a significant contribution to the model. Therefore, if the *t*-test correlated with a β value is significant then the independent variables are making a significant contribution to the model. For this research, the WEB_U (usability dimension), WEB_SIQ (service interaction quality dimension) and WEB_IQ (information quality dimension) with $p < 0.001$ is significant predictors of end-user satisfaction.

Based on above data analysis, H1, H2 and H3 are proven since there is positive association between usability dimensions (WEB_U); information quality dimension (WEB_IQ); Service Interaction Quality (WEB-SQ) and user satisfaction. The association between dependent and independent variable results significant at $p < 0.001$. Therefore researcher can conclude that the regression model from this research in significantly better prediction of end-user. Coefficient correlation indicates that about 54% of the variance in SUM_US is explained by the function: SUM_US= 0.701 + 0.394WEB_U +0.221WEB_IQ +0.255WEB_SQ.

DISCUSSION, RECOMMENDATION AND IMPLICATIONS

This study investigates user satisfaction in e-library system and to examine the association between user satisfaction and quality dimension of WEBQUAL. A theoretical framework is developed, through the integration of WEBQUAL theory (Barnes and Vidgen) and 2-item criteria global end-user satisfaction (Doll-Torkzadeh). The model is then tested empirically through preliminary analysis before examine it used linear regressions. Dropped 2-item from the instrument, it doesn't mean that instrument not valid in measuring website quality. Since in this study most of user

didn't conduct with security issue that's why user not really cares about "my personal information feels secure" (Q15) and also "the website has a good reputation" (Q14).

Coefficient correlation indicates that about 54% of the variance in SUM_US is explained by the function: SUM_US= 0.701 + 0.394WEB_U +0.221WEB_IQ +0.255WEB_SQ. It means that end-user information satisfaction is strongly affected by usability dimension such as degree of easy to learn, easy to operate, degree attractive appearance, design of website, conveys sense of competency and user positive experience sense. Usability dimension alone can explain 45% of end-user satisfaction. It is important for library management to keep the high score for usability dimension. Absolutely it is also important for library management to increase another dimensions. According to previous researcher (Liu et al, 2006), although ease of use is important, the usefulness of the information systems is even more important, in this case information quality dimension. Furthermore they said end-user is likely to have positive attitudes about the systems if they believe that using the system will increase their performance and productivity. It seems that users will tolerate the difficulties of using a system because of the functions it performs for them. Actually it can shows from some of the comments from respondent in this research:

"Search engine have low speed"
"Some of the data from search engine not math with the stuff (ex: CD resource) on shelf"
"Search engine should have more criteria"
"The database about on-line resource is not enough complete"

Every study has its limitation, and this one is no exception. The limitation arises from the component of website quality. The researcher didn't identify and test for any additional component of end-user satisfaction. The researcher just used WEBQUAL instrument and 2-item global criteria, since this instrument already common use to examine end-user satisfaction regarding website.

Actually it is possible for e-library service, even likely, that there are some other components of satisfaction such the degree of completely journal collection or on-line annual report collection (see the above respondent' comments).

There are a number of avenues of future research. As researcher mentioned in the limitation, researcher measured end-user satisfaction using established measure components. Future research should attempt to identify additional components of satisfaction that are specific to e-library environment. Since the result from this study found that 54% of end-user satisfaction is explained by the three independent variables, this means 46% of end-user satisfaction cannot explain by WEBQUAL dimension alone. Therefore there must be other variables that have an influence also.

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