FROM DESIGN FEATURES TO FINANCIAL PERFORMANCE: A COMPREHENSIVE MODEL OF DESIGN PRINCIPLES FOR ONLINE STOCK TRADING SITES[1]

Youngsu Lee
Dept. of Business Administration
Internet Business Research Center
Yonsei University
Seoul, Korea
bakdraft@yahoo.com

Jinwoo Kim
Dept. of Business Administration
Internet Business Research Center
Yonsei University
Seoul, Korea
jinwoo@yonsei.ac.kr

ABSTRACT

As e-business grows rapidly, interests in design principles for e-business web sites are increasing. A few studies have suggested design principles with concrete design features, but failed to link the features to the performance of an e-business site, such as attitudes of its customers or financial performance of the e-business company. This paper proposes a comprehensive framework that covers from concrete design features to financial performance for online stock trading, which is one of the most important domains of e-business. The proposed model for online stock trading sites consists of three design principles: functional convenience, representational delight, and structural firmness. Through empirical studies, this research found that the convenience, delight and firmness principles were closely related to the level of customer satisfaction, and, consequently, to the level of customer loyalty to the sites. We also identified important design features such as presentation of stock quotes in the homepage for each of the three design principles. Finally, the study results showed that customer loyalty would affect the financial performance of online stock trading companies. This paper concludes with the implications and limitations of the results.

1. Introduction

With the emergence of the Internet as a new medium of doing business, many businesses have changed from offline to online businesses (US Dept. of Commerce, 1998). An enormous amount of investment went into building the Internet sites, or so-called e-business sites, and changing the conventional companies into new online companies. However, the financial performance of e-businesses such as transaction volume and profits vary widely contrary to optimistic expectations. Why are some e-businesses successful and most others are not?

Several studies attempted to provide an answer to this question, but they did not fully consider all the characteristics of e-business, from the concrete design features to the performance of an e-business company. Previous researches have examined a wide range of topics focused on customers' behavior on the virtual store (e.g., Hoffman and Novak, 1996; Bhatnagar *et al.*, 2000), design of e-businesses sites (e.g., Lohse and Spiller, 1998: 1999), and new business models in the Internet (e.g., Timmers, 1999). However, not many studies investigated the impact of concrete design features and design principles on the financial performance of web sites (Hong and Kim, 2002).

In this research, we suggest a comprehensive model that starts from design features of a web site to the financial performance of an e-business company. Among various e-business domains, we chose online stock trading for two reasons. First, online stock trading is one of the fastest growing e-businesses (Jupiter Communications, 1999). The *online stock trading* is defined as a process of trading financial products especially stocks over the Internet, and online stock trading *site* is a web site that helps traders or customers to buy and sell the financial products over the Internet (Fan *et al.*, 2000). Over 30% of total transaction in the stock market is made through online stock trading sites around the world, and over 60 % is made in the Korean financial market as of the end of 2000 (KSDA, 2000). Second, online stock trading as an Internet intermediary or Internet pure player (Cisco and UT Austin, 1999) is regarded to include most of the important characteristics

[1] This study was supported by a Korea Research Foundation Grant (KRF-2000-005-C00012).

of e-business systems. It connects buyers and sellers by providing virtual access to stock markets, and enables transaction between buyers and sellers of various financial products by providing financial marketplace. Therefore, the critical design features found in the online stock trading site may be general enough to be applied to other kinds of e-businesses.

However, despite the growing importance of online stock trading businesses, few studies have investigated important design principles that are critical to the financial success of online stock trading companies. Most of earlier studies dealt with strategic issues of online stock trading (e.g., Kauffman *et al.*, 2000), technical issues of the online stock trading sites (e.g., Konana *et al.*, 2000), or behavioral issues of online customers (e.g., Hong, 2000) *independently*. However, in order to identify critical design features and principles, the relationships among the technical design issues, customer behavior issues, and managerial issues need to be investigated *altogether*. What design features and principles of web sites influence customer behavior, which in turn affects the financial performance of online stock trading companies?

In order to answer these questions, we propose a comprehensive model that includes design features and principles of online stock trading *sites*, behavior of online stock trading *customers*, and financial performance of online stock trading *companies*. The model consists of three phases: the first phase identifies design features (e.g., search function) of online stock trading sites in terms of important design principles (e.g., convenience principle): the second tries to relate the actual design features of the online stock trading sites to subjective evaluations of customers (e.g., customer loyalty): the third phase relates the subjective evaluations of customers to the performance (e.g., transaction volume) of the online stock trading companies.

In order to verify the proposed model, we conducted an in-depth monitoring of most online stock trading sites currently on operation in Korea and a large-scale survey with online stock trading customers. The results helped identify the critical design features that are closely related to the design principles of web site development, which are found to be closely related to customer satisfaction and customer loyalty to online stock trading sites, which in turn are found to be closely related to the financial performance of the online stock trading companies. This paper consists of a literature review, a theoretical overview of the proposed model of the online stock trading sites, the methods and results of the empirical studies, and concludes by discussing the implications of the results.

2. Theoretical and Practical Backgrounds

2.1. Prior Research on Online Stock Trading

Although online stock trading has come into practice recently, the interests it has attracted have been steadily growing as the Internet has drawn the attention of practitioners and researchers (Konana *et al.*, 2000; Lee and Chung, 2000; The Economist, 2000; Kauffman *et al.*, 2000; Fan *et al.*, 2000; Hong, 2000; Barber and Odean, 2001). Practitioners have paid attention to online stock trading as a convenient tool for trading financial products and services including stocks, bonds, futures, and option (Lee and Chung, 2000; The Economist, 2000). Researchers have shown interest in online stock trading as information intermediaries in the Internet economy (Cisco Systems and UT Austin, 1999; Kauffman *et al.*, 2000). Broadly speaking, there have been three approaches taken by the prior researches on online stock trading.

First, the studies in the economic approaches generally focus on cost aspects of online stock trading in financial markets (Barber and Odean, 2001; Konana *et al.*, 2000). For example, Konana (2000) finely organized customers' selection behavior of online stock trading in terms of low transaction cost, which has brought many customers to the virtual market. However, considering that there are diverse needs for online stock trading such as real time access to stock market information and convenience of ordering, emphasizing low transaction cost only does not appear to fully explain the critical issues of the online stock trading, such as trading site reliabilities.

The second approach is about the competitive status of the online stock trading companies (The Economist, 2000; Kauffman *et al.*, 2000; Lee and Chung, 2000). The researches in this category mainly dealt with strategic issues of the newly opened online stock trading companies. For example, Kauffman (2000) argues that recent online stock trading companies need to modify their strategy to permeate through the online stock trading market because they have relatively weak competitive advantage, which is to say strategic vulnerability particularly in providing financial market analysis report. The researches put special emphasis on the importance of an online stock trading companies as information intermediaries that give added value to the customers (Bakos, 1998; Sarkar *et al.*, 1996). These researches have given general strategic guidelines to online stock trading companies, but they lacked in concrete guidelines for the web sites of the trading companies, which are considered as one of the key success factors in e-businesses (Lohse and Spiller, 1999)

The final approach is to focus on the customers' behavior using online stock trading sites (Barber and Odean, 2001; Hong, 2000). The researches extensively collected individual customers' data on online trading, but they only revealed the individual preference using online trading compared to the conventional offline

trading. Therefore, they did not prove what design features and principles of the online stock trading sites were closely related to the performance of its companies.

In summary, although interests in online stock trading have grown, prior researches focused only on limited aspect of online stock trading, not representing its entirety. Considering the enormous investment under progress on online stock trading businesses, researches that deal with design factors and principles of web sites, behaviors of stock trading customers, and financial performance of trading companies altogether are in dire need.

2.2. A Comprehensive Model of Design Principles

2.2.1. Designing Principles for Online Stock Trading Sites

We propose design principles and criteria for online stock trading sites based on the metaphor of web sites as buildings (Mitchell, 1995; Winograd, 1997). Just as a building is a typical artifact that people construct in real space, a web site is a typical artifact that people build in cyber space. Web sites can be regarded as buildings in cyber space for two reasons. First, web sites and buildings serve similar objectives. Buildings offer physical living space in the real world. Web sites can be considered to offer a virtual living space in the cyber world. In other words, buildings such as marketplaces, schools, post offices, and libraries in the real world can be compared to the web sites of virtual malls, education sites, e-mail sites, and portal sites in the cyber world (Mitchell, 1995). Second, customers' perspectives are important both for web sites and for buildings because both have the ultimate goal to provide appropriate experiences for customers (Gonzales *et al.*, 1997; Liao and Cheung, 2001). Both the architecture of web sites and buildings therefore emphasize the quality of customers' experiences. For example, stable structures and convenient functions are important factors for both web site customers and building residents. The design quality of web sites therefore may be similar to that of buildings from the perspective of customer experience.

Buildings have been usually designed and appraised from three interrelated perspectives based on the works of the famous Roman architecture critic Vitruvius: utilitas, venustas, and firmitas (Rasmussen, 1959). *Firmitas* refers to the structural firmness of architecture (Giedion, 1941). A building has to be firm enough to protect inhabitants from all external threats such as cold winds and snow. It also has to stand firm through internal erosions in order to avoid collapsing. *Utilitas* means the appropriate spatial accommodation of architecture. A building should provide space suitable for the purposes for which it is intended (Giedion, 1941). Finally, *venustas* represents the delight of architecture (Rasmussen, 1959). These three perspectives are later elaborated in the domain of POE (Post Occupancy Evaluation), which is the process of evaluating buildings in a systematic and rigorous manner after they have been built and occupied for some time (Zimring and Reizenstein, 1980; Preiser *et al.*, 1988; Gonzales *et al.*, 1997). This conceptual framework of architectural principles is used in this study as a useful tool in organizing design principles for online trading sites.

One of the advantages of using the building metaphor is that we can learn from the conceptual framework of architectural principles that has been used to design buildings for over a thousand years (Giedion, 1941). Many design principles have been proposed in the course of development and evaluation of web sites (Smith, 1997; Selz and Schubert, 1997; Webby Awards, 2001; Survey Site Inc., 2001). However, these principles generally lack a strong theoretical background, suggesting several principles based on existing practices with no explicit theoretical constructs (e.g., Webby Awards, 2001). Others suggest a considerable amount of design principles without any justification of why they are needed (e.g., Gomez, 2001). Using the building metaphor allows us to borrow the conceptual framework that has been missing in most studies in web site design.

Another advantage of using the building metaphor is that we can construct a comprehensive framework of trading site design, which led us to include important design factors that had not been dealt in previous studies. For example, firmness had not been previously used as an important design principle in other studies (Liu and Arnett, 2000). Neither TAM (Technology Adoption Model) in the information systems field (Davis, 1989; Malholtra *et al.*, 1999), nor TRA (Theory of Reasoned Action) in the organizational/customer behavior field (Fishbein and Ajen, 1975; Ajen, 1991) included structural firmness in their models. This may be because previous studies primarily dealt with the usage of information systems in corporate organizational environment and therefore experiencing structural firmness while using the systems might not have been important (Venkatash, 2001). However, online stock trading systems are different from traditional information systems in that they can be used almost anywhere by anybody in everyday life. For example, firmness is especially important for online stock trading sites with which customers usually transact relatively a large amount of money. Therefore, the building metaphor enables us to construct a comprehensive set of design principles that fits better to the specificities of online stock trading sites.

Functional Convenience Principle

Providing convenient functions for online customers to complete their intended activities is an important design principle because convenience is one of the most important factors that increase customer satisfaction (Davis, 1989). Convenience principle includes two sub-processes of transaction for online stock trading site:

information gathering (Schubert and Selz, 1999; Hong, 2000) and *order making* process (Selz and Schubert, 1997; Schubert and Selz, 1999). Online stock trading site should help customers find the provided information from the system and make an order very easily (Lohse and Spiller, 1998; Selz and Schubert, 1997).

First, timely and useful information from the online stock trading site is highly critical to the decision-making of the customers (Perry and Bodkin, 2000; Huang *et al.*, 1999; Strong, 1997; Wang, 1998; Wang and Strong, 1996). As the number of independent online customers increases, the information provided by the trading site becomes crucial. The information supplied, which would include market information, real-time stock quotes, and in-depth company research reports, should help their decision-making process. In addition to the stock market information, customers' usage manual should be available for customers to get appropriate information from the system. The value of the information provided is subjectively determined by the customer's needs. Therefore, the quality of information should be considered from the customer's perspective.

Second, in addition to information, order-making process is another important aspect of convenience. Order-making process includes all the activities of ordering and post-purchasing, such as correcting the errors in the trading process, as well as cost involved in the process. Because the actual stock exchange occurs in the transaction process, the cost including the commission rate and perceived transaction cost also serves as important elements in making customers satisfied with the transaction process.

Representational Delight Principle

Delight principle contains two sub-factors for online stock trading site: *interface to the system* and *interface to people*. Online stock trading site should help customers of stock trading sites feel delighted when interacting with the system and interacting with co-customers (people) of the system (Kim, 1999). A recent study has found that interfaces between customers and businesses, as well as among customers, are important variables for the success of e-businesses (Liu and Arnett, 2000).

First, providing a pleasant system interface is important for representational delight. Interface to the system means the interface between human and computer (Lohse and Spiller, 1998). The interface to the system is important in that customers would return to the site if it provided interesting and entertaining interface experience (Benjamin, 1995; Rice, 1997). It has been also found that homepage presentation is a major antecedent of consumer satisfaction in e-business (Ho and Wu, 1999).

Second, the interface to people refers to the interface between customers or traders. The interface to people is getting important because the communication with other people is one of the key features of the Internet and the community function of the Internet draws a high level of attention (Armstrong and Hagel, 1996). It is noted that most e-businesses allow buyers and sellers to interact through the electronic medium (Liu *et al*., 1997). The interface to people can be implemented by many communication-oriented facilities such as bulletin boards and chat rooms.

Structural Firmness Principle

It is argued that buildings should be strong enough to endure all the environmental threats. Likewise, online stock trading sites should be robust and firm enough to provide the traders with a sense of security in using the system (Jones *et al.*, 2000), especially because the volume of monetary transaction on an online stock trading site is enormous. Therefore, we hypothesize that structural firmness is an important design principle that may affect customer satisfaction of, and loyalty to, the online stock trading sites. A survey conducted by the European Messaging Association, for example, revealed that the vast majority of respondents demand structural firmness before they conducted any electronic transaction activities on the web (Shankar, 1996).

The design factors for structural firmness are composed of *robustness* and *security*. Robustness means the stability of an online stock trading site so that the customers can comfortably and quickly access the system without system crash. Robustness can be measured by perceived stability of the system and accessibility of information quality (Huang *et al.*, 1999). Security denotes the safety level and it can be measured by trust measures and plausibility of service quality (Zeithaml, 1988).

The three principles and six sub design factors for the online stock trading site are summarized in Table 1: information gathering and order making for convenience, interface to the system and interface to people for delight, and robustness and security for firmness, respectively.

2.2.2. A Research Model

Based on the design principles for the online stock trading site, a research model was derived. The research model was divided mainly into three parts: an on-site monitoring of actual system design features, a survey of subjective evaluation of the trading site, and an analysis of the performance of the stock trading companies. First, system design features refer to the components of the online stock trading sites such as menu structure and icons[2], which the customers actually see and click while using the site. Second, subjective evaluation denotes

[2] System design features are explained in detail in Table 2.

customer evaluation of the system quality, which includes overall customer satisfaction and customer loyalty to the trading site[3]. Finally, the performance of the company means how much transaction is executed through a certain web site, and the performance can be measured by the actual volume of transaction. These three parts are related as shown in Figure 1.

Table 1. Three principles, six sub design factors, and examples of design features for online stock trading sites

Principles	Sub Design factors	Examples of Design Features
Convenience	Information gathering	Objectivity, up-to-datedness, and usefulness of information, offering of in-depth analysis report
	Order making	Order process, commission rate, effectiveness of the ordering process, completeness of transaction, customer support
Delightfulness	Interface to the system	Convenience of menu-structure, ease of identifying location in the system, harmony of screen design, consistency of information representation
	Interface to people	B-C and C-C communication, personalized service
Firmness	Robustness	Stability of the system, access speed
	Security	Protection of the private information, and transaction information, transaction security tools, transaction trust

First, from the system design features to the design principles, the design features of online stock trading sites affecting the subjective evaluation of three main principles will be examined. A detailed analysis of the relation may identify critical design features among myriad of factors that are closely related to the three design principles.

H1: Design features will be positively related to the corresponding design principles.

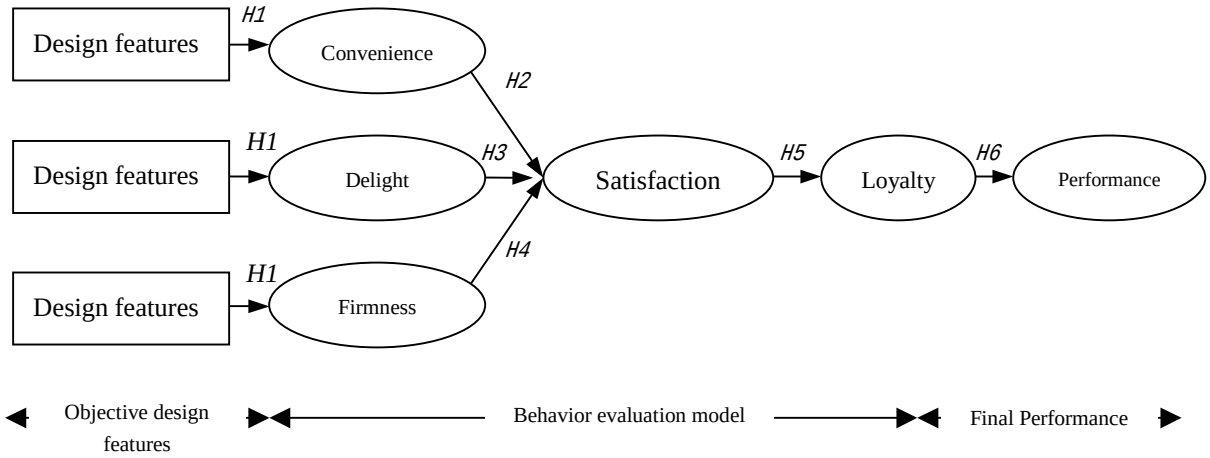

Figure 1. Research model from design features to the performance of the system

[3] The questionnaire for the subjective evaluation is explained in detail in Table 4.

Second, based on the subjective evaluation of the customers on the three principles (convenience, delight, and firmness) for online stock trading sites, the relationship between the three principles and customers' overall satisfaction with the site will be examined. Customer satisfaction, which is one of the most frequently used measures of system success, is a subjective evaluation of the consequences of using the web site on a pleasant-unpleasant continuum (Seddon, 1997; Lewis, 1995). Since satisfaction is the attitudinal evaluation of a product or service after actual consumption or use (Howard and Sheth, 1967; Oliver, 1996), the level of satisfaction is considered as a key measure to determine the subjective success of the online stock trading site as a service or software system (DeLone and McLean, 1992). Finally, the relationship between overall satisfaction and customer loyalty should be also examined because the satisfied customer would repeatedly use the product or service (Oliver, 1996). Customer loyalty is the customer's intention to visit the web site again based on their previous experiences as well as future expectations (Czepiel and Gilmore, 1987; Berry, 1995). It is especially important for an online stock trading site to ensure that customers repeatedly visit the site, as its value is determined predominantly by the number of loyal customers (Rose *et al.*, 1999). If none of the customers is willing to visit again, then the site's business value becomes worthless despite its technical or managerial assets.

H2; The convenience principle will positively affect the level of customers satisfaction.

H3; The delight principle will positively affect the level of customers satisfaction.

H4; The firmness principle will positively affect the level of customers satisfaction.

H5; The customer's level of satisfaction will increase the level of loyalty to the online stock trading site.

Finally, loyal customers will help boost the profitability of a company in the long run (Anderson *et al.*, 1994; Johnson and Gustafsson, 2000). Thus it is vital to explore the relationship between loyalty and transaction volume. This research attempts to verify the model by analyzing the relationship between the level of customer loyalty and the actually realized financial performance of the online stock trading company.

H6: The customer's level of loyalty of an online stock trading site will increase the performance of the online stock trading site.

3. Research Method

This research conducted three related studies to verify the proposed research model. The first one was an on-site monitoring that mainly dealt with the site design features categorized under the three design principles for the online stock trading sites, the second one was a survey that focused on the subjective evaluation according to the same principles, and the final one was the performance data analysis of the online stock trading companies. The units of analyses are a web site for the on-site monitoring which an online stock trading company operates, an individual respondent for the survey, and an online stock company for the performance analysis.

3.1. On-site Monitoring

We conducted an on-site monitoring to identify the important design features that are closely related to the customers' evaluation toward the sites they are using. As shown in Table 2, eighty-three objective monitoring items, including important design features for online stock trading sites, were selected by a committee of twelve experts who had at least five years of experience in the e-business field. The committee, chaired by the second author, included a professional developer of online stock trading sites and a system operator for websites that provided stock investment information. In order to assure the comprehensiveness of the set of monitoring items, the initial monitoring items were then discussed in a public hearing and modified in line with the opinions expressed at the hearing[4].

Using the on-site monitoring scheme, we investigated design features of thirty-one out of thirty-four online stock trading sites that were on operation in Korea at the time of research. The company names and site domains of the thirty-one selected sites are summarized in Table 3. Three sites were excluded from the study because their market shares were negligible and consequently we could not find enough number of respondents for the sites in our online survey, which will be explained in the next section.

[4] The set of monitoring items was devised as part of the effort to construct a Korean e-business award system mandated by the Korean Government.

Table 2. On-site monitoring items

Design Factors	Examples of On-site Monitoring Items
Information Gathering	In-depth analysis report, link to the related information, information about the use of the online stock trading sites, installation manual for the trading emulator, overall explanation of how to use the trading site, explanation about the transaction process
Order Making	Number of ordering method, account information during ordering process, commission rate for online stock trading, Q & A section for the transaction result, customer support operation (e.g. call center, BBS, email), set-up for self interested quote
Interface to The System	Offering of search function, search options, direct navigation to a certain menu, horizontal scroll bar at 800*600 resolution
Interface to People	B-C communication tools (e.g. BBS, newsletter, email list), B-B communication tools (e.g. BBS, SIG, chatting, messenger), number of messages in the BBS for one week, membership service, personalized menu structure, up-to-date notice
Robustness [5]	Compatibility with browsers, system crash
Security	Security level, responsibility of the authorities, log-in / log-out function, terms of service

Table 3. The company names and site domains of the thirty-one online stock trading sites

Company name	Domain URL	No. of Respondents	Company name	Domain URL	No. of Respondents
E*Trade Korea	etrade.co.kr	224	Samsung	samsungfn.co.kr	859
E-Mirae Asset	miraeasset.com	214	Sejong	sejongiz.co.kr	198
KGI	kgieworld.co.kr	74	Seoul	seoulstock.co.kr	72
LG Investment	iflg.com	522	Shinyoung	shinyoung.co.kr	93
SK	webtrade.co.kr	119	Shinhan	shcyber.co.kr	193
GetMore	getmore.co.kr	64	Shinheung	shs.co.kr	102
Kyobo	kyobotrade.co.kr	185	Yuhwa	yhs.co.kr	32
Good Morning	goodmorning.co.kr	193	First Bank	powerstock.co.kr	74
Daishin	daishin.co.kr	818	Cheil Investment	cjcyber.co.kr	68
Daewoo	bestez.com	449	Kiwoom	kiwoom.com	226
Daeyu	daeyu.co.kr	67	Hana	clickhana.co.kr	70
Dongbu	winnet.co.kr	115	Hanvit	hanvitsec.co.kr	153
Tongyang	myasset.co.kr	172	Hanyang	hanyangsec.co.kr	38
Dongwon	dws.co.kr	221	Hanhwa	koreastock.co.kr	219
Meritz	meritzsec.co.kr	126	Hyundai	stockmarket.co.kr	544
Bookook	bookook.co.kr	72			

In order to code the design features of selected online stock trading sites, two independent coders were recruited and trained in the coding schema for the design features with two sample online stock trading sites. At the end of the training session, the coders were asked to evaluate a test site, and the authors verified the

[5] Robustness could not be checked because actual system access speed was dependent on the network status of on-site monitoring site.

results of their coding for the test site. The training session took a whole day; the two coders were able to correctly code the test site by the end of the day. Then the two coders investigated the design features of the selected trading sites independently. After both had coded a site, they were asked to reconcile their codings for any inconsistencies. Finally, the authors of this paper examined the reconciled codings as double-check.

3.2. Online Survey

Thirty-six subjective evaluation questions were selected based on the three principles. Actual questions used in the survey and their sources are provided in Table 4. The first column shows the serial number of questions used in the survey, the second column displays variables, the third column shows actual questions used in the survey, and the last column shows reference sources of the questions. The actual questions were slightly modified from their original references so as to best fit the online stock trading sites.

Table 4. Actual questions for subjective evaluation of online stock trading sites

No.	Variables	Questions	Source
S1	Dependent Variable	The cyber-trading site is overall satisfactory.	Oliver *et al.*, 1996
S2		I could effectively achieve what I want.	
L1		I would re-use the cyber-trading site when I invest in stocks.	Oliver *et al.*, 1996
L2		I will keep liking the online stock trading site.	
Q1	Independent Variable	The information is reliable.	Huang *et al*., 1999
Q2		The information is objective.	Huang *et al*., 1999
Q3		The information is helpful to my decision-making.	Huang *et al*., 1999
Q4		The cyber-trading site provides the enough up-to-date information.	Huang *et al*., 1999
Q5		The information is easily understandable.	Huang *et al*., 1999
Q6		The information is simple and concise.	Huang *et al*., 1999
Q7		I can easily place an order.	Selz et al., 1997
Q8		The commission rate is relatively low compared to other cyber-trading site.	Perceived Cost
Q9		I can easily get the information from the system.	
Q10		I can easily correct an error I make during the ordering process.	Selz et al., 1997
Q11		The transaction is settled as I intended.	Selz et al., 1997
Q12		The information about the occurring problems is appropriately provided after transaction is made.	Selz et al., 1997
Q13		When it comes to the problem during the transaction process, I can be rewarded as it was written in the information.	Selz et al., 1997
Q14		The menu structure is easy to use.	Davis, 1989
Q15		A customer can easily learn to use the online stock trading site.	Chin, 1988
Q16		I can easily point out where I am in the online stock trading site.	Davis, 1989
Q17		I can easily recognize the entire structure of the online stock trading site.	Davis, 1989
Q18		The mood and screen design of the online stock trading site are harmonious.	Zeithaml, 1988
Q19		The words and icons are easily represented.	Chin, 1988
Q20		The information is consistently represented.	Chin, 1988
Q21		The online stock trading site supports various communication tools among customers.	Berry, 1995
Q22		The online stock trading site immediately responds to the customers' questions.	Zeithaml, 1988
Q23		The online stock trading site helps customer to easily make special interest groups in the system.	Bonding
Q24		The online stock trading site offers customized service.	Zeithaml, 1988
Q25		The online stock trading site is stable to use.	Trust
Q26		Downloading time is appropriate.	Access Speed
Q27		The online stock trading site supports speedy access at any condition.	Huang *et al*., 1999
Q28		I can easily access to the online stock trading site.	Huang *et al*., 1999

Q29	I can quickly get the information from the online stock trading site.	Huang *et al*., 1999
Q30	The online stock trading site accurately keeps information about transaction history and account balance.	Zeithaml, 1988
Q31	The online stock trading site protects customer's individual information.	Trust
Q32	The online stock trading site is secure.	Jones *et al*., 2000
Q33	I can trust the online stock trading site, when I process important financial transaction.	Jones *et al*., 2000
Q34	I can trust the online stock trading site at any special cases.	Trust
Q35	I think the online stock trading site operates consistently.	Huang *et al*., 1999
Q36	The online stock trading site is reliable on its functionality and service transaction.	Zeithaml, 1988

A nation-wide online survey was conducted for two weeks in order for customers to evaluate the thirty-one online stock trading sites currently on operation in the Korean market. The respondents were recruited via banner advertisements at several popular portal sites in Korea. The respondents were asked to subjectively evaluate one online stock trading site where their major accounts existed. Social security number and IP address were checked to make sure that each person responded only once. They were asked to answer the survey questions based on their experience of the online stock trading site. Each respondent answered the questions in Table 4 using 7-point Likert scale. Since the survey questions were written in Korean, most respondents were local residents in Korea.

4. Study Results

4.1. Survey Results

The total number of participants after their validity check in the survey was 6,576. 89% of the respondents were male and 11% were female, and the demographics are summarized in Table 5. The number of respondents for each of the thirty one online trading sites is shown in Table 3. Also, the means and standardized deviations of survey responses are given in Table 6.

Table 5. Demographics of survey respondents

Total Respondents		6,576
Sex (%)	Male	88.6
	Female	11.4
Age (%)	20-29	19.8
	30-39	56.7
	40-49	20.7
	Over 50	2.8

Table 6. Mean and standard deviation of responses to the questions

Q	Mean	SD	Q	Mean	SD	Q	Mean	SD
Q1	4.24	1.32	Q13	3.49	1.36	Q25	4.32	1.50
Q2	4.19	1.25	Q14	4.46	1.54	Q26	4.13	1.52
Q3	3.92	1.44	Q15	4.71	1.45	Q27	3.88	1.52
Q4	3.89	1.39	Q16	4.54	1.43	Q28	4.19	1.44
Q5	4.38	1.34	Q17	4.47	1.49	Q29	4.14	1.49
Q6	4.27	1.34	Q18	4.42	1.42	Q30	4.89	1.57
Q7	4.58	1.48	Q19	4.48	1.45	Q31	4.67	1.37
Q8	3.69	1.74	Q20	4.37	1.36	Q32	4.44	1.31
Q9	3.79	1.35	Q21	3.74	1.36	Q33	4.46	1.39
Q10	4.12	1.52	Q22	3.72	1.39	Q34	4.04	1.42
Q11	4.76	1.45	Q23	3.35	1.38	Q35	4.24	1.36
Q12	3.99	1.42	Q24	3.28	1.48	Q36	4.07	1.37

Factor analysis using the Varimax rotation was conducted to diagnose whether the questions were well defined to reflect the meanings of the constructs. The results of the factor analysis and reliability tests are

shown in Table 7 and 8. The results indicated that the six extracted factors reliably corresponded to the constructs represented in the research model, as the values of Cronbach's Alpha were high enough to fit the reliability tests.

Table 7. Factor analysis result for the independent variables

	Factors	eigen value	Cronbach's Alpha	1	2	3	4	5	6
Q15	Interface to the system	17.373	0.932	0.781	0.233	0.163	0.053	0.122	0.163
Q14				0.776	0.194	0.164	0.144	0.179	0.142
Q16				0.772	0.244	0.181	0.122	0.198	0.171
Q17				0.764	0.219	0.173	0.162	0.181	0.147
Q19				0.746	0.225	0.211	0.219	0.187	0.015
Q18				0.728	0.230	0.231	0.240	0.181	0.035
Q20				0.626	0.240	0.306	0.301	0.227	0.011
Q7				0.425	0.310	0.271	-0.013	0.259	0.350
Q32	Security	2.273	0.930	0.272	0.757	0.225	0.164	0.199	0.101
Q31				0.289	0.747	0.210	0.133	0.189	0.084
Q33				0.290	0.734	0.230	0.192	0.247	0.121
Q34				0.196	0.669	0.210	0.348	0.236	0.145
Q30				0.339	0.662	0.159	0.030	0.221	0.074
Q35				0.259	0.644	0.254	0.302	0.253	0.134
Q36				0.173	0.615	0.242	0.412	0.201	0.204
Q11				0.396	0.425	0.196	-0.024	0.308	0.402
Q3	Information gathering	1.822	0.909	0.113	0.124	0.754	0.214	0.118	0.142
Q1				0.186	0.275	0.752	0.114	0.103	0.157
Q2				0.174	0.281	0.745	0.116	0.099	0.169
Q4				0.155	0.139	0.724	0.309	0.191	0.092
Q5				0.324	0.185	0.692	0.115	0.191	0.051
Q6				0.314	0.180	0.671	0.168	0.193	0.090
Q9				0.226	0.119	0.486	0.344	0.223	0.396
Q23	Interface to people	1.521	0.878	0.132	0.123	0.179	0.811	0.163	0.105
Q24				0.128	0.141	0.163	0.783	0.182	0.122
Q22				0.224	0.232	0.226	0.697	0.170	0.161
Q21				0.279	0.212	0.269	0.677	0.186	0.132
Q13				0.097	0.314	0.173	0.476	0.120	0.435
Q27	Robustness	1.236	0.920	0.188	0.275	0.132	0.248	0.776	0.149
Q26				0.253	0.269	0.157	0.142	0.757	0.119
Q29				0.264	0.243	0.295	0.271	0.697	0.086
Q28				0.296	0.255	0.293	0.254	0.689	0.095
Q25				0.342	0.374	0.186	0.184	0.591	0.129
Q8	Order Making	1.044	0.635	0.055	0.032	0.167	0.190	0.017	0.713
Q10				0.349	0.250	0.163	0.157	0.266	0.515
Q12				0.253	0.361	0.181	0.291	0.252	0.513

Table 8. Factor analysis result for the dependent variables

	Factors	eigen value	Cronbach's Alpha	1	2
L1	Loyalty	3.104	0.867	.915	.307
L2				.733	.560
S1	Satisfaction	0.382	0.812	.314	.910
S2				.567	.675

4.2. Relationship between monitoring results and survey results

In order to find out the relations between the design features of the online stock trading sites and the subjective evaluation of the six design principles for the system, regression analyses using stepwise method were conducted six times, once for each design principles. The dependent variable of the analysis was the average factor score for each web site. The independent variables were design features for each of the six design

factors monitored from individual online stock trading sites. The unit of the regression analysis was the web sites for the individual stock trading companies. The regression results are summarized in Table 9.

Table 9. The results of the regression analyses between design features and subjective evaluation[6]

Dependent Variable (Sub design factors)	Independent Variables (Design features)	df	F	AR[a)]	Sig[c)]	Beta Coefficient	Sig[d)]
Information Gathering	Presentation of stock-quotes in the homepage	1	4.984	0.117	0.033	0.503	0.033
Order Making	Commission rate	1	15.616	0.502	0.000	-0.515	0.001
	The presentation of the account information during the ordering process [b)]					0.425	0.004
Interface to the System	Offering of search function in the web-based trading site [b)]	1	8.764	0.211	0.006	0.488	0.006
Interface to people	Number of C-C communication tools in emulator-based system	1	11.682	0.269	0.002	0.543	0.002
Robustness	The use of developed system by the operating company	1	9.829	0.227	0.004	0.503	0.004

First, in the case of the design features for information, presentation of stock quotes in the homepages was found to be positively related to the subjective evaluation of information gathering. Adjusted R-square was 0.117 for the information and beta coefficient was 0.503. Second, in the case of the design features for order making process, commission rate is negatively (β=-0.515) related to the subjective evaluation of transaction process, whereas the indication of account information during the ordering process is positively related to (β=0.425) the subjective evaluation of the order making process of the online stock trading sites. The adjusted R-square of the regression model was 0.502 and the model was statistically significant at the level of 0.01. Third, in the case of the design features for interface to the system, offering of search function in the trading sites is positively related to the subjective evaluation of the interface to the system. The adjusted R-Square of the regression model was 0.211 and beta coefficient was 0.488. Fourth, in the case of the design features for interface to people, the number of customer-to-customer communication tools such as bulletin board systems, chatting rooms, and instant messaging is positively related to the subjective evaluation of the interface to people. The adjusted R-square of the model was 0.269 and the beta coefficient was 0.543. Finally, the introduction of a particular online stock trading site developed by operating companies is positively related to the evaluation of the robustness of the system with adjusted R-Square of 0.227 and beta-coefficient of 0.503. Therefore, the first hypothesis *(H1)* was accepted because at least one design feature was found to be closely related to the corresponding three design principles.

4.3. Structured Equation Model for Online Stock Trading

After identifying the system design features that were related to the subjective evaluation of the system, a structured equation model analysis, LISREL, was performed to investigate the relationship among the three design principles for the online stock trading site, customer satisfaction and customer loyalty. The six extracted sub design principles from the factor analysis and subjective level of satisfaction and loyalty were used as observed values to the LISREL model, and three main principles for the online stock trading site and level of satisfaction and loyalty were used as latent values in the model. The mean values of the questions for each of the six sub design factors were used as inputs to the LISREL analysis, and the analysis results are shown in Figure 2.

The several indicators of the LISREL analysis, such as adjusted goodness of fit index (AGFI=.90), standardized root mean square residuals (SRMR=.049), and normed fit index (NFI=.96) showed that the suggested model had the acceptable goodness of fit to proceed to a further analysis (p<0.01). The summarized result of the LISREL analysis is shown in Table 10 below.

[6] a) stands for adjusted R-square. b) indicates that the independent variables were entered in the model as dummy variables. c) is the significance of the regression model, and d) is the significance of the beta coefficient.

Figure 2. Multi-phased structural model of online stock trading and coefficients of the model

Table 10. Summary of the structured equation model for online stock trading site

Model	χ^2	df	GFI	AGFI	NFI	SRMR
	1211.84	16	0.95	0.90	0.96	0.049

The coefficients of the paths in Figure 2 and the model summarized in Table 10 supported the second hypothesis (*H2*) that the convenience principle will positively affect the level of satisfaction of the customers, the third hypothesis (*H3*) that the delight principle will positively affect the level of satisfaction of the customers, and finally the fourth hypothesis (*H4*) that the firmness principle will positively affect the level of satisfaction of the customers. Their respective coefficients were 0.46 (t=3.77), 0.23 (t=4.42), and 0.28 (t=3.97). They were all statistically significant at the level of 0.05. The fifth hypothesis (*H5*) that the level of satisfaction of the customers of an online stock trading site would increase the level of loyalty to the online stock trading site was supported according to the model: the coefficient is 0.88 (t=106.23) and statistically significant at the level of 0.01. The results indicate that all three principles affect the level of satisfaction and also the level of customer satisfaction significantly affects the level of customer loyalty.

4.4. Relations with Financial Performance of the Online Stock Trading Site

Finally, it was verified whether or not the subjective level of customer loyalty would affect the actual financial performance of the online stock trading companies. There are numerous ways to evaluate the performance of an online stock trading site. The measure of financial performance of the online stock trading site used in this study was the total transaction volume made through an online stock trading site per month at the time of the study. Transaction volume is used as the performance measure, for the size of the transaction volume can be a key measure of determining the success of trading sites. Moreover, since all online stock trading companies must report its exact transaction volume to KSDA (Korean Stock Dealers Association) by regulation in Korea, the transaction volume per month is one of the most reliable data that is practically available for the financial performance of online stock trading companies. A regression analysis was conducted to verify the relationship between customer loyalty and transaction volume, and the result of the analysis is shown in Table 11. The independent variable was the average of customer loyalty level for each online stock trading company, and the dependent variable was the transaction volume for the company. Therefore, the unit of analysis was the individual online stock trading company.

Table 11. The result of the regression analysis between the level of satisfaction and the financial performance of the online stock trading sites

Dependent Variable	Independent Variables	df	F	AR	Sig	Beta Coefficient	Sig
Total volume of an online stock trading site	Subjective level of customers' loyalty	1	6.657	0.159	0.015	0.432	0.015

As the result of the regression model suggested, the level of customer loyalty is positively related to the transaction volume made through the online stock trading site. The relation was statistically significant at the level of 0.05.

5. Conclusions and Discussions

Two main studies and three statistical analyses were conducted to verify the relationship among web site design principles and its sub principles, customer satisfaction and loyalty, and performance of the online stock trading sites. The composite results are summarized in Figure 3 below. First, the analysis of design features and subjective evaluation identified important design features that influenced the subjective evaluation of the convenience of the system; presentation of stock quotes, commission rate, presentation of the account information for the convenience principle; offerings of the search function in the web-based trading site, number of customer-to-customer communication tools in the online stock trading site for the delight principle; and operation of proprietary system for the firmness principle. Second, the structured equation model analysis showed that all three principles (convenience, delight and firmness) positively influenced the level of satisfaction and it consequently increased the loyalty of the site customers. Lastly, the simple regression analysis showed that the level of customer loyalty positively increased the system performance.

The result of the regression model for design features and the structured equation model showed distinct characteristics of the online stock trading sites. As shown in the structured equation model in Figure 3, convenience, delight and firmness were identified as design principles that exert significant influence on the level of customer satisfaction. Since customers generally expect positive results in the form of a monetary return (Konana *et al.*, 2000) by using the online stock trading sites, the precise quality of information gathering and the prompt processes of order making on the online stock trading site would affect the level of satisfaction. Likewise, because the interface is what customers actually see and click while using online stock trading sites,

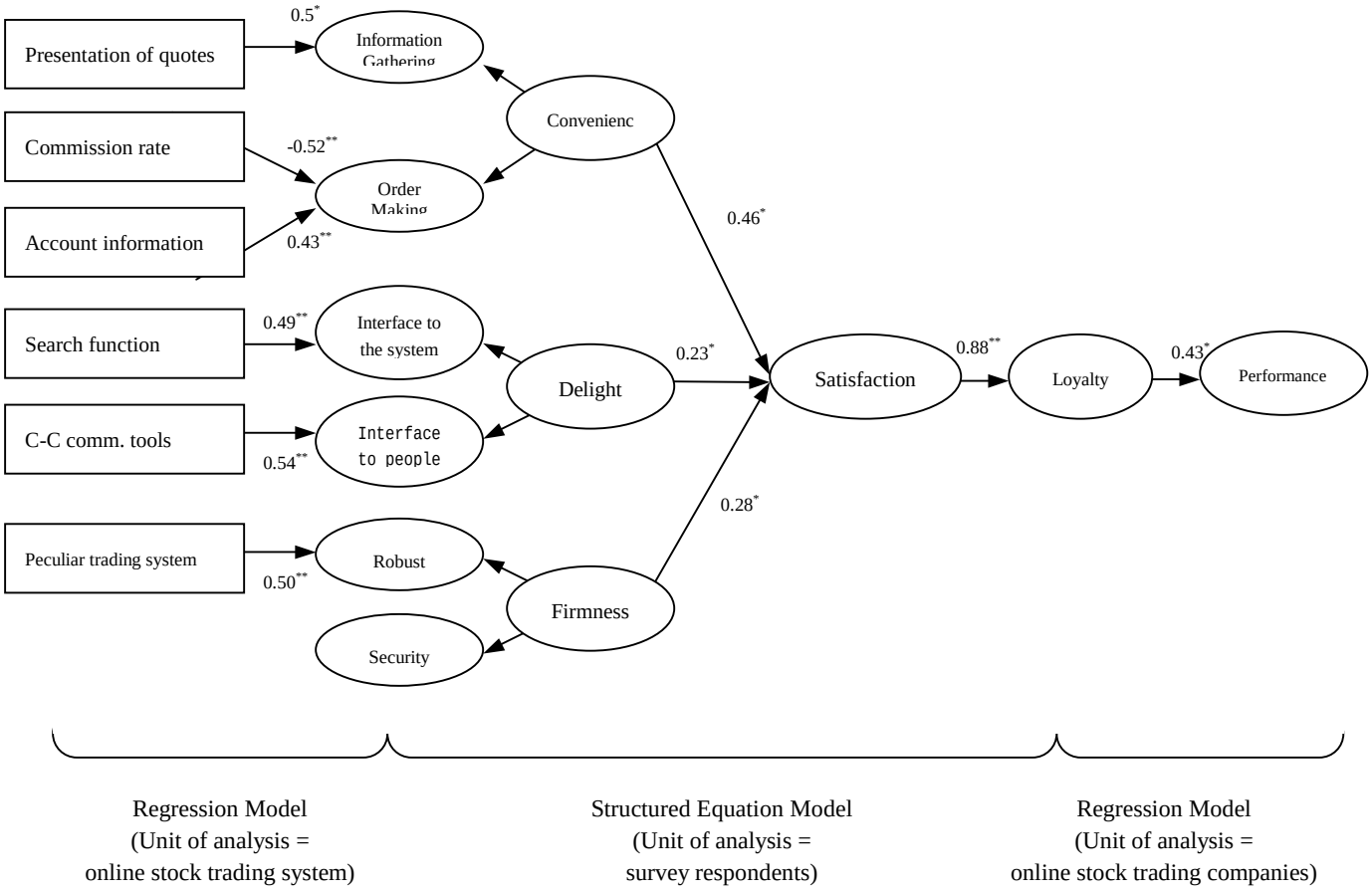

Figure 3. The summary results of three research models for online stock trading sites

customers can be delighted by the interfaces of the system and the interface to people. In addition to the convenience and delight, the firmness of the online stock trading site was identified as another significant principle that influences the level of satisfaction. Considering that the average volume reaches up to $4,000 per transaction (KSDA, 2000), the site should be perceived as something the customer could feel secure and safe about.

This research has a few limitations. First, questions might arise about whether monitoring items for the site design features fully address all the important design features for the online stock trading site. The monitoring

items that described three principles and six sub design factors were selected through a committee composed of industry experts. In the process, we excluded some design features, such as content quality of the provided information and network bandwidth, due to the limitations of on-site monitoring method. This may be the reason why no design features were identified as significant for the security design factor. However, since we defined the design features as the objects that customers actually see and click, the excluded features should be included in a future study. Second, the selection of respondents should be randomized to verify the result in the survey method. In this research, we did not choose the respondents randomly given the characteristics of the online survey using the web. Therefore, the process might have induced respondents to self-select an online stock trading site regardless of their usage, and that would have resulted in biased responses toward respondents' view of the online stock trading site. However, in our survey, we asked the respondents to select and evaluate the online stock trading site where they have existing accounts. And the purpose of the study was not to rate the trading sites but to verify the relationships from design features to the performance of the trading sites. Finally, the proposed model was empirically tested in Korean Internet financial market, one of the fastest growing markets in the world (The Economist, 2000). Knowing that each financial market and online stock trading sites have its own characteristics, we need to be careful in applying the implications of the research results to other countries and other industries.

Despite the limitations of the study, there are several noteworthy points in the results of the study, both theoretically and practically. First, the theoretical contribution of the study comes from the comprehensive conceptual model and research method. We introduced the causal model of three components (web site design features, subjective evaluation, and financial performance) of online stock trading sites. Although there have been several previous studies that investigated concrete design features of online stock trading sites, behavioral characteristics of customers, or performance of online stock trading companies *independently*, the relationship among the three has been hardly examined in a single study *altogether*. By analyzing the design features, behavioral characteristics and financial performance in a single study, we could connect the concrete design features to the final performance, which has been hardly examined in the earlier studies in web usability. Analyzing the three components together in a single study enables us to answer the important question the e-commerce practitioners ask: 'where to invest the limited resources to achieve the most effective results from the trading site?' Attaining effective results out of a trading site can be accomplished through increased customer satisfaction and loyalty, and in turn increased transaction volumes (Anderson, 1994; Oliver, 1996). This study identified six critical design features that are closely related to the ultimate aim of increased transaction volume.

Second, the practical implication of the study results is to recognize the critical design features for online stock trading site. Although only six design features were recognized as having influence over the subjective evaluation of a system, the features based on the three principles for the online stock trading sites could be fundamental in designing an online stock trading site with a high volume of transaction. For example, presenting stock-quotes in the homepage of trading sites and providing the account information during the ordering process were found to be closely related to the perceived convenience of the trading sites. It was in turn found to be closely related to customers' perceived level of satisfaction and loyalty toward the trading sites, which was consequently related to the financial performance of the trading sites. Therefore, by focusing on these design features, practitioners are able to develop more effective online stock trading sites.

REFERENCES

Ajen, I., The Theory of Planned Behavior. *Organization Behavior and Human Decision Process*, 50, 1991.

Anderson, E. W., Fornell, C., and Lehmann, D. R., "Customer Satisfaction, Market Share, and Profitability: Findings from Sweden", *Journal of Marketing*, Vol. 58: 53-66, July 1994.

Armstrong, A., and Hagel, J., "The Real Value of Online Communities", *Harvard Business Review*, 74(3): 134-141, 1996.

Bakos, Y. "The Emerging Role of Electronic Marketplaces on the Internet", *Communications of the ACM*, Vol. 41(8): 35-42, August, 1998.

Barber, B. M., and Odean, T., "Online Investors: Do the Slow Die First?", Working Paper, referred to http://faculty.gsm.ucdavis.edu/~odean/ on February 2001.

Benjamin, R. I., "Electronic Markets and Virtual Chains on the Information Superhighway", *Sloan management Review*, 36(1): 62-72, 1995.

Berry, L., "Relationship Marketing of Services: Growing Interest, Emerging Perspectives", *Journal of the Academy of Marketing Science*, 23(4): 236-245, 1995.

Bhatnagar, A., Misra, S., and Rao, H.R., "On Risk, Convenience, and Internet Shopping Behavior", *Communications of the ACM*, Vol. 43 (11): 98-105, November 2000.

Chin, J.P., Diehl, V.A., Norman, K.L., "Development of an Instrument Measuring User Satisfaction of the Human-Computer Interface," *The proceedings of ACM CHI*, 213-218, 1988.

Cisco systems and University Texas at Austin, *Measuring the Internet Economy*, http://www.internetmetrics.com, 1999.

Czepiel, J. A., and Gilmore, R., "Exploring the Concept of Loyalty in Services. in J.A. Czepiel, C. A. Congram, and J. Shanahan(ed.)", *The Services Challenge: Integrating for Competitive Advantage*, Chicago, IL: American Marketing Association, 91-94, 1987.

Davis, F.D., "Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology," *MIS Quarterly*, 13(3): 319-340, 1989.

DeLone, W. H., and McLean, E. R., "Information systems success: The quest for the dependent variable", *Information Systems Research*, 3(1): 60-95, 1992.

The Economist, "Survey: The New Economy", Sept., 2000.

Fan, M., Stallaert, J., and Whinston, A. B., "The Internet and the Future of Financial Markets", *Communications of the ACM*, 43(11): 82-88, 2000.

Fishbein, M., and Ajzen, I., *Belief, Attitude, Intention, and Behavior: An Introduction to Theory and Research*, Reading, MA: Addision-Wesley, 1975.

Giedion, S., *Space, Time, and Architecture: The Growth of a New tradition*. Cambridge, MA: Harvard University Press, 1941.

Gomez, *Consumer evaluation* [on-line]. Available: www.gomezpro.com, 2001.

Gonzales, M., Fernandez, C., and Cameselle, J., "Empirical Validation of a Model of User Satisfaction with Buildings and Their Environments as Workplaces. *Journal of Environmental Psychology*, 17: 69-74, 1997.

Ho, C. F., and Wu, W. H, "Antecedents of Customer Satisfaction on the Internet: An Empirical Study of Online Shopping", *Proceeding of the 32nd Hawaii International Conference on System Sciences*, 1-9, 1999.

Hoffman, Donna L. and Novak, Thomas P., "Marketing in Hypermedia", *Journal of Marketing*, Vol. 60: 50-68, July 1996.

Hong, S. J., "Information-Processing Costs in Online Stock Trading", *EM - Electronic Markets*, 10 (3), November 2000.

Hong, S. and Kim, J., "A Comprehensive Evaluation Methodology of Web Sites as Living Places in Cyber Space", *Internet Business Research Center Working Paper Series*[on-line], Available: http://ibiz.re.kr, 2002.

Howard, J. A. and Sheth, J. N., "A Theory of Buyer Behavior", *Marketing Classics*, Prentice Hall, 1995. The article was originally published in *Changing Marketing Systems … Consumer, Corporate, and Government Interfaces: Proceedings of the 1967 Winter Conference of the American Marketing Association*, 1967, AMA.

Huang, K., Lee, Y., and Wang, R., *Quality Information and Knowledge*, Prentice Hall, 1999.

Johnson, M. D. and Gustafsson, A., *Improving Customer Satisfaction, Loyalty, and Profit: An Integrated Measurement and Management System*, Jossey-Bass, 2000.

Jones, S., Wilikens, M., Morris, P., and Masera, M., "Trust Requirements in E-Business", *Communications of the ACM*, Vol. 43 (12): 80-87, December 2000.

Jupiter Communications, Financial Service Online, http;//www.jup.com, Sept. 1999.

Kauffman, R. J., Mani S., and Wood, C. A. "Analyzing Information Intermediaries in Electronic Brokerage", *Proceedings of the 33rd Annual Hawaii International Conference on System Science (HICSS)*, 2000.

Kim, J. and HCI Lab., *A Customer-centric Internet business development approach: InternetBusiness.com*, YoungJin.com, November, Seoul, Korea, 1999.

Konana, P., Menon, N. M., and Balasubramanian, S., "The Implications of Online Investing", *Communication of the ACM*, Vol. 43, No. 1: 34-41, 2000.

KSDA (The Korean Securities Dealers Association), *An Analysis on Online Securities Transaction*, Oct., 2000.

Lee, K., and Chung, N., "Empirical Study on a Business Model for the Internet-based Stock Trade", *Korean Management Information Systems Review*, 10(2): 125-147, Seoul, Korea, 2000.

Lewis, J. R, "IBM computer usability satisfaction questionnaires: Psychometric evaluation and instructions for use", *International Journal of Human-Computer Interaction*, 7(1): 57-78, 1995.

Liao, Z., and Cheung, M. T., "Internet-based e-shopping and Consumer Attitudes: An Empirical Study", *Information & Management*, 38: 299-306, 2001.

Liu, C., and Arnett, K. P., "Exploring the Factors Associated with Web Site Success in the Context of Electronic Commerce", *Information and Management*, 38 (1): 23-33, 2000.

Liu, C., Arnett, K.P., Calella, L., and Beatty, B., "Web sites of the Fortune 500 companies: facing customer through home pages", *Information and Management*, 31(1): 335-345, 1997.

Lohse, Gerald L. and Spiller, Peter, "Electronic Shopping: The effect of customer interfaces on traffic and sales", *Communications of the ACM*, 41(7): 81-88, July, 1998.

Lohse, Gerald L. and Spiller, Peter, "Internet retail store design: How the user interface influences traffic and sales", *Journal of Computer Mediated Communication*, 5(2), December, 1999. referred to http://www.ascusc.org/jcmc/vol5/issue2/lohse.htm.

Mitchell, T., *City of bits: Space, place, and the Infobahn*, Cambridge, MA: MIT Press, 1995.

Oliver, R. L., *Satisfaction: A Behavioral Perspective on the Consumer*, McGraw-Hill, 1996.

Perry, M. and Bodkin, C., "Content Analysis for Fortune 100 Company Web Sites", *Corporate Communications*, 5(2): 87-96, 2000.

Preiser, W., Rabinowitz, H., and White, E., *Post-occupancy Evaluation*. NY: Van Nostrand Reinhold, 1988.

Rasmussen, S., *Experiencing Architecture*. Cambridge, MA: MIT Press, 1959.

Rice, M., "What makes users revisit a web site?", *Marketing News*, 31(6): 12, 1997.

Rose, G., Khoo, J., and Straub, D. W., "Current technological impediments to business-to-consumer electronic commerce", *Communications of the AIS*, 1(16): 1-74, 1999.

Sarkar, M. B., Butler, B., and Steinfield, C., "Intermediaries and Cybermediaries: A Continuing Role for Mediating Players in the Electronic Marketplace", http://www.ascusc.org/jcmc/vol1/issue3/sarkar.html, 1(3), *Journal of Computer Mediating Communication*, 1996.

Schubert, P., and Selz, D., "Web Assessment – Measuring the Effectiveness of Electronic Commerce Sites Going Beyond Traditional Marketing Paradigm", *Proceedings of the 32nd Hawaii International Conference on System Science (HICSS)*, 1999.

Seddon, P., "A respecification and Extension of the DeLone and McLean Model of IS Success", *Information Systems Research*, 8 (3): 240-253, 1997.

Selz, D., and Schubert, P., "Web Assessment-A Model for the Evaluation and the Assessment of Successful Electronic Commerce Applications", *EM - Electronic Markets*, Vol. 7, No. 3.: 46-48, 1997.

Shankar, B., "Electronic commerce will be a big business", *Telecommunications*, 30(7): 24, 1996.

Smith, A.G., "Testing the Surf: Criteria for Evaluating Internet Information Resources", *The Public Access Computer Systems Review*, 8(3): 5-23, 1997.

Strong, D.M., Lee, Y., and Wang, R., "Data Quality in Context", *Communications of the ACM*, 40(5): 103-110, 1997.

Survey Site Inc., "How Web Site Evaluation Works", In *Website Evaluation* [on-line], Available: http://www.surveysite.com/newsite/docs/howork.htm, 2001.

Timmers, P., *Electronic Commerce: Strategies and Models for Business-to-Business Trading*, John Wiley & Sons, 1999.

US Dept. of Commerce, *The Emerging Digital Economy*, Dec., 1998.

Venkatash, V., "A Longitudinal Investigation of Personal Computers in Homes: Adoption Determinants and Emerging Challenges", *MIS Quarterly*, Vol. 25(1): 71-102, 2001.

Wang, R.Y., "A Product Perspective on Total Data Quality Management", *Communications of the ACM*, 41(2): 58-65, 1998.

Wang, R.Y. and Strong, D.M., "Beyond Accuracy: What Data Quality Means to Data Consumers", *Journal of Management Information Systems*, 12(4): 5-33, 1996.

Webby Awards, *Judging criteria* [on-line], Available: http://www.webbyawards.com/judging/criteria.html, 2001.

Winograd, T., and et. al., *Bringing Designs to Software*, ACM Press, 1996.

Zeithaml, V. A., Berry, L. L. & Parasuraman, A., "Communication and Control Process in the Delivery of Service Quality", *Journal of Marketing*, Vol. 52: 35-48, 1988.

Zimring, C. M., and Reizenstein, J., "Post-occupancy Evaluation: An Overview", *Environment and Behavior*, 12(4): 429-450, 1980.