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User Dissatisfaction on the High-Speed Internet Service Quality

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■ Abstract ■

The growth of Internet usage even accelerated by the spread of high-speed Internet access network such as ADSL is affecting our socioeconomic activities and culture in a great way. Korea is recently reported to be the number one high-speed Internet network subscription per 100 people in the world. In a way to reflect this situation, we collect a moderate size of sample proportional to the population of each region across country and investigate what factors might explain the level of user's dissatisfaction with respect to Internet service they have been receiving. The results indicate that the set of gender, age, Internet usage, service kinds, incoming *e*-mails, and *e*-shopping is significantly influencing user's dissatisfaction, in that dissatisfaction is measured in 11 perspectives. In particular, user's age, gender, and *e*-shopping experiences are considered to be mostly explainable.

Keyword : High-Speed Internet Access Network, Internet Service, User Dissatisfaction

1. Introduction

As a new device for information gathering and supporting work, Internet has become an indispensable part of our life over the last decade. Together with the advancement of network tech-

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nology and multimedia functions, we rely more on computers than ever before. Younger generation, in particular, who are quite acquainted with computer technology and eager to spend money and effort on new information devices, is believed to lead Internet culture. Nowadays most young groups access to the Internet service via a high-speed Internet access network like ADSL. Understanding and forecasting the behaviors and psychological status of these active Internet users might play an important role setting up business strategies in many industries.

There exist a number of studies on the effects of Internet on our socioeconomic activities and culture. *E*-commerce-related research would be one of the most popular topics so far. Especially business-to-customer Internet shopping has been much of interest to researchers as well as practitioners. Factors that distinguish Internet users and non-Internet users have been searched. Some studies claimed the potential power of Internet as a next generation retail channel [4]. However, most studies have not taken into account the current situation of Internet access in their analyses.

The number of Internet users in Korea is exploding, almost doubling each year since 1997. As of December 2001, approximately 24 million people, who are 56% of the entire population, were using the Internet[7]. What is more interesting is the fact that many more users are shifting from traditional modem access to the high-speed Internet access network. According to the August 2001 edition of ITU News, Korea ranked the first in the high-speed Internet access network users in the world. Organization of Economic Cooperation and Development (OECD) announced that Korea is the top country in the spread of high-speed Internet access network under an article titled "The Republic of Korea's Success with ADSL" in May 2001[6].

In the next section, we review former studies about the Internet-related issues such as commerce, service, problems, and user satisfaction. Section 3 presents the research questions and hypotheses proposed in this study. Section 4 summarizes the findings of the sampled data and then discusses the hypotheses testing results. Finally, concluding remarks follow with some suggestions for further study.

2. Former Studies on Internet Service

Among the various definition of Internet, a popular one is that the Internet is rather a logical information network than a physical connection of computers and networks. Starting from ARPANET of the U.S. department of defense, the Internet expanded its roles into research and commercial uses with the introduction of TCP/IP protocols. Due to the rapid spread of high-speed Internet access networks, Internet today functions in many ways, e.g., from work to pleasure.

Many studies are focused on the characteristics of Internet users. Donthu and Garcia[5] analyzed the differences between Internet shoppers and non-Internet shoppers with respect to socioeconomic characteristics (e.g., age, income, and sex) and motivational characteristics (e.g., innovativeness, impulsiveness, and risk aversion). Significant differences are found in age, income, innovativeness, impulsiveness, and risk aversion in the two groups. Liao and Cheung [8] concluded that, in Singapore, willingness to shop online has a positive correlation with many

factors such as user's lower level of awareness of security risks, higher level of user's computer education, lower level of prices of products or services, less needs to make other sensitive judgments than appearance in deciding purchasing, and higher level of shopper's trust of and loyalty to suppliers.

Despite its difficulty to judge the quality of products and services as well as security concerns, *e*-shopping is growing owing to many strengths such as convenience, time saving and cheap prices, and no implicit pressure to buy from clerks. Studies on online purchasing behaviors[10, 13] often involved the benefits and risks associated with *e*-shopping as a determinant of purchasing willingness. *E*-shopping is influenced by several factors, which might be categorized as follows : a product awareness factor like price and quality, a customer service factor like security and visibility, a risk factor like personal and economic risks, and an experience factor like environment and pleasure.

For Internet users, *e*-mail is the most common form of exchanging information and documents as well as communication. With the help of Internet portal sites such as Yahoo or AOL, Internet users are benefited in many ways, e.g., conveniently acquiring various information they want. However the downside of *e*-mail usage comes with what is so called spam mail problems. It is an annoying problem to users just as tons of physical mails are delivered to the household in the U.S.A. This problem certainly lowers the user satisfaction in Internet environment. Several algorithms to filter or block Spam mails using artificial intelligence data mining techniques are developed and put into practice these days[2, 11, 12].

Computer problems related with hacking type activities are also another important factor making Internet users unpleasant. Since its early appearance on phone systems and mainframe computers, hacking is prevalent everywhere, even in major government systems with the advancement of computer networks.

The "SERVQUAL" model suggests five categories for quality of service in general, which are security, assurance, tangibility, empathy, and responsiveness[14]. These properties are often adopted and modified to operationalize customer satisfaction in Internet studies. For example, to measure customer satisfaction regarding Internet shopping, several factors should be considered such as security of Internet shopping and convenience of information search and ordering. Dealaert and Kahn[3] found from their experiment that waiting or buffering time upon Internet use has a negative influence on consumer's evaluation of web sites. Lynch and Ariely[9] concluded from their experiments that lowering service charges for product information search over the Internet is not felt significantly by consumers.

We have found that most existing studies focus on issues related to *e*-commerce and analyze the effects of demographic factors, characteristics of products and services offered, and so on. They do not consider changes in the Internet access environment in their analyses. Studies on the effects of transition in the Internet access network are quite limited yet, making it difficult to establish policies and business strategies appropriate to the changes in the users' Internet usage environment[1]. From this perspective, this study collects data on the high-speed Internet network users with a moderate sample size

across the country and analyzes what factors might explain the level of dissatisfaction with respect to several aspects of Internet service.

3. Research Questions and Hypothesis

3.1. Research Model and Hypotheses

Most former studies on Internet service have been focused on analyzing user's behavior pattern and satisfaction without considering the Internet access network. Since the Internet access network is rapidly shifting from modem access to the high-speed network like ADSL, this study tries to analyze the factors that affect the level of user's dissatisfaction in the high-speed Internet access network. The high-speed Internet access network includes ADSL, ISDN, Internet-leased lines and cable TV modems.

The six independent variables adopted in this study are gender, age, the amount of Internet usage, the kinds of Internet services used, the amount of incoming *e*-mails, and the *e*-shopping experience. For each set of independent variables, 11 dependent variables are regressed separately, which are the levels of user's dissatisfaction on Internet services.

Dissatisfaction is measured in terms of 11 categories : method of use ; easiness of operation ; information search ; time spent ; line congestion ; service fee ; provider's response ; personal information release ; security of transaction ; legal protection ; damage by hacking.

This study performs 11 separate multiple regression analyses with the set of six independent variables to identify which independent variables affect what type of user's dissatisfaction. The regression model is :

$$Y_i = b_o + b_1 X_1 + b_2 X_2 + b_3 X_3 + b_4 X_4 + b_5 X_5 + b_6 X_6 \ (i = 1, 2, \cdots, 11) \quad (1)$$

where X_1 = gender ; X_2 = age ; X_3 = the amount of Internet usage ; X_4 = the kinds of Internet services used ; X_5 = the amount of incoming *e*-mails ; and X_6 = the *e*-shopping experience ; Y_1 = method of use ; Y_2 = easiness of operation ; Y_3 = information search ; Y_4 = time spent ; Y_5 = line congestion ; Y_6 = service fee ; Y_7 = provider's response ; Y_8 = personal information release ; Y_9 = security of transaction ; Y_{10} = legal protection ; Y_{11} = damage by hacking.

Each regression model consists of a set of six hypotheses, which are :

[Hypothesis with respect to gender]

Gender has a significant influence on each type of user's dissatisfaction in Korean high-speed Internet network.

[Hypothesis with respect to age]

Age has a significant influence on each type of user's dissatisfaction in Korean high-speed Internet network.

[Hypothesis with respect to Internet usage]

The amount of Internet usage has a significant influence on each type of user's dissatisfaction in Korean high-speed Internet network.

[Hypothesis with respect to service kinds]

The number of Internet services used has a significant influence on each type of user's dissatisfaction in Korean high-speed Internet network.

[Hypothesis with respect to incoming *e*-mails]

The number of incoming *e*-mails has a signifi-

cant influence on each type of user's dissatisfaction in Korean high-speed Internet network.

[Hypothesis with respect to *e*-shopping]

The number of Internet shoppings has a significant influence on each type of user's dissatisfaction in Korean high-speed Internet network.

The significance level of 5% is used for the probability of Type I error to determine whether each independent variable has a significant effect on the dependent variable. The independent variables with p-value of less than 0.05 are considered to be statistically significant.

3.2 Sample Description and Survey Questions

The survey was carried out from February 2 to 18, 2001 for the people who receive Internet service in other environments than companies and schools. The sample consists of two parts : one is collected using panels of Embrain company and the other using general Internet users. The sampled users are confined to those who were aged 18 or more. The number of subjects was proportionally assigned to each region according to its population size and age group in order to ensure the sample representativeness across the country. The region covers Seoul and six other metropolitan cities. Respondents answered the questionnaires on the Internet.

The independent variables are as follows. First, gender consists of male and female. Second, age is a numerical variable with a minimum age of 18. Third, Internet usage has eight categories from one for the most frequent users to eight for the least frequent users. Forth, service kinds refer to the number of services used during the recent two to three months. The kinds of services include *e*-mail, mailing list, magazines and newspapers, web sites, e-shopping, e-auction, electronic bulletin boards and electronic conference rooms, home page opening, paid information services, Internet stock trading, *e*-banking, instant message, and short message services. Fifth, incoming *e*-mails represents the number of mails received in a week with the exclusion of short or character message services that are available to mobile subscribers only. Lastly, *e*-shopping represents the number of Internet shoppings over the last year.

For the 11 aspects of Internet services, i.e., for the 11 dependent variables, the level of user's dissatisfaction/concern/complaints are measured using a five-point scale. Upon the questionnaire "How much or How often are you dissatisfied with the corresponding aspect of Internet services?", respondent rates 1 point for always, 2 point for a little, 3 point for sometimes, 4 point for rarely, and 5 point for never .

4. Analysis Results

4.1 Sample Characteristics

Out of 2,206 respondents, this study uses the 1,823 respondents who were using high-speed Internet access network, which includes ADSL, ISDN, CATV, Internet-leased lines, and LAN. The sample characteristics are summarized as follows.

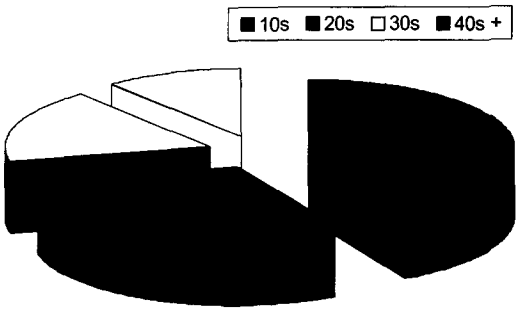
- Gender

The male respondents are 942 (51.7%) while females are 881.

- Age

The respondents with the age of 10s occupy

approximately 42%, 20s are 29%, 30s are 18%, and 40s or more are 11%(see <Figure 1>). Since the proportion of 10s and 20s combined are about 71%, it tells that the younger generation represents the majority of Internet users who access the Internet more often, spend more time on Internet, participate in various activities, and express and claim their opinions.



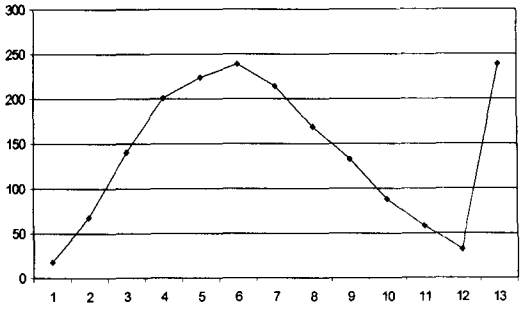
〈Figure 1〉 Age distribution

• Internet Usage

Around 81% of respondents answered that they access the Internet at least once a day. Next, 11% of respondents access the Internet four to six times a week. Fewer people answered on less often Internet access questionnaires. In other words, Internet usage follows an exponential type distribution. Again this signals that this survey was answered by those who might represent the majority of Internet users.

• Service Kinds

<Figure 2> illustrates that the respondents can be characterized by a bimodal distribution with respect to the number of services used. Among the 13 available services, one large group tends to use about half the services (i.e., five to seven services) and the other large group uses all the available services.



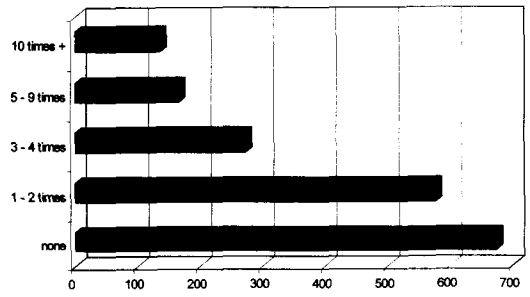
〈Figure 2〉 The distribution of respondents by the number of services used

• Incoming *e*-mails

The distribution of incoming *e*-mails for our sampled data looks right-skewed with a long tail. The average number of incoming *e*-mails is about 30 a week with a great standard deviation of 37.6.

• *E*-shopping

Although *e*-commerce has rapidly grown over the last decade, it seems to be a very small part of our everyday purchasing activities. As depicted in <Figure 3>, about 37% of respondents never involved in *e*-shopping activities over the previous year, and about 47% of respondents participated in *e*-shopping one to four times.



〈Figure 3〉 *E*-shopping experience

<Table 1> analyzes the *e*-shopping pattern by age. The distribution of *e*-shopping differs significantly with p-value of less than 0.0001 accord-

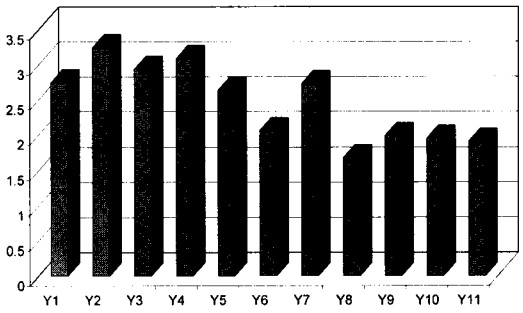
ing to a chi-square test. The age group of 10s has a smaller purchasing power compared to adult groups. This is indicated by a smaller proportion of less shopping (none and 1~2 times) for the age group of 10s. More frequent online buyers are identified as the age group of 20s. For the groups of three or more shoppings, 20s are the biggest group. It is also interesting to note that the two most frequent buyers (10 times or more) are the groups of 20s and 30s, i.e., 65% of most frequent buyers on the Internet are aged 20s and 30s.

〈Table 1〉 The frequency table by *e*-shopping and age group

e-shopping \ age	10s	20s	30s	40s +	total
None	378	146	89	60	673
1~2 times	227	172	110	67	576
3~4 times	82	104	52	34	272
5~9 times	53	60	34	19	166
10 times +	30	47	42	17	136
total	770	529	327	197	1,823

• Dissatisfaction Level

Using the notations in Equation (1), the levels of dissatisfaction/concern/complaints are measured for 11 perspectives. <Figure 4> shows that personal information release is the most concerned issue for Internet users. The dissatisfaction is high for the issues related with service fee, personal information release, security of transaction, legal protection, and damage by hacking. Other than these, the dissatisfaction levels are not low for the remaining aspects. This might be one of the reasons why *e*-shopping is still in its introductory stage and Internet users perceive a high risk of leaking personal data and credit information on online activities. In other words, online security must be strengthened to foster *e*-commerce.



〈Figure 4〉 Dissatisfaction levels

4.2 Hypothesis Test Results

According to the model p-value in <Table 2>, we can be more than 95% confident that the set of independent variables has significantly affected each aspect of the dissatisfaction levels. For each aspect of user's dissatisfaction, the interpretations are as follows.

For dissatisfaction with respect to the method of use, all independent variables except Internet usage are found to be significant. Female Internet users feel more dissatisfied than male users. As age groups get older, they feel more dissatisfied. The ones who use more kinds of Internet services tend to feel more comfortable with respect to the method of use. Internet users who use more *e*-mails and do *e*-shopping are also less dissatisfied with respect to the method of use.

For dissatisfaction with respect to the easiness of operation, all independent variables except service kinds are found to be significant. The levels of dissatisfaction are higher for females, older age groups, less frequent users, less *e*-mail use groups, and less *e*-shopping groups.

For dissatisfaction with respect to information

search and time spent, age, Internet usage, and *e*-shopping are found to be significant. The levels of dissatisfaction are higher for older age groups, less frequent users, and less *e*-shopping groups.

For dissatisfaction with respect to line connection and congestion, gender and age are only the influencing independent variables. Female users and older group feel more dissatisfied with line congestion matters.

For dissatisfaction with respect to service fee and provider's response, age is the only significant independent variable. Older users think that they pay more than what has to be paid for their services and that they deserve more speedy and better response from Internet service providers.

For dissatisfaction with respect to personal information release, gender, age, and *e*-shopping are found to be influential. Female users, older group users, and less *e*-shoppers are more dissatisfied with respect to personal information and credit related information release and security matters.

For dissatisfaction with respect to the security of transaction, legal protection, and damage by hacking, both gender and age are the only explainable independent variables. Female users and older group users are more meticulous with respect to security related matters.

In summary, gender might explain the difference in dissatisfaction level with respect to the

〈Table 2〉 Multiple regression results for each dependent variable : t-stat./p-value

	Model *p*-value	Gender	Age	Internet usage	Service kinds	Incoming *e*-mails	*e*-shopping
Method of use	0.0001*	8.13/ 0.0001*	-5.06/ 0.0001*	-1.89/ 0.0587	3.13/ 0.0018*	3.14/ 0.0017*	4.45/ 0.0001*
Easiness of operation	0.0001*	6.79/ 0.0001*	-4.76/ 0.0001*	-2.60/ 0.0093*	-0.01/ 0.9913	3.78/ 0.0002*	5.85/ 0.0001*
Information search	0.0001*	1.77/ 0.0774	-2.60/ 0.0095*	-2.40/ 0.0167*	0.21/ 0.8316	0.96/ 0.3386	2.99/ 0.0028*
Time spent	0.0001*	1.29/ 0.1984	-2.65/ 0.0082*	-1.96/ 0.0498*	-0.01/ 0.9907	0.94/ 0.3475	3.02/ 0.0025*
Line congestion	0.0006*	3.02/ 0.0026*	-3.20/ 0.0014*	-1.27/ 0.2038	-0.19/ 0.8458	-0.68/ 0.4955	1.63/ 0.1037
Service fee	0.0051*	-1.22/ 0.2212	-3.54/ 0.0004*	0.85/ 0.3932	-1.06/ 0.2890	-0.87/ 0.3855	-0.03/ 0.9785
Provider's response	0.0001*	-1.90/ 0.0573	-4.03/ 0.0001*	0.05/ 0.9635	-1.11/ 0.2661	-2.51/ 0.0123*	-1.35/ 0.1762
Personal information release	0.0001*	3.51/ 0.0005*	-3.27/ 0.0011*	0.81/ 0.4163	0.90/ 0.3661	-0.51/ 0.6101	-2.74/ 0.0063*
Security of transaction	0.0012*	3.36/ 0.0008*	-2.27/ 0.0231*	-0.74/ 0.4589	0.82/ 0.4115	-1.41/ 0.1582	1.71/ 0.0871
Legal protection	0.0001*	3.89/ 0.0001*	-3.52/ 0.0004*	0.12/ 0.9065	0.74/ 0.4596	-0.50/ 0.6186	-1.73/ 0.0844
Damage by hacking	0.0001*	5.26/ 0.0001*	-2.54/ 0.0111*	0.99/ 0.3230	0.31/ 0.7555	-0.19/ 0.8479	-0.61/ 0.5394

Note) * denotes significance at alpha of 5%

method of use, the easiness of operation, line congestion, personal information release, the security of transaction, legal protection, and damage by hacking. Age is the only independent variable that explains different levels of dissatisfaction for all aspects. E-shopping experience might explain dissatisfaction with respect to the method of use, the easiness of operation, information release, time spent, and personal information release. Other independent variables are rather trivial. Internet usage can uniquely explain the easiness of operation, information search, and time spent. Service kinds can explain the method of use only. Dissatisfaction with respect to the method of use, the easiness of operation, and provider's response are uniquely explained by incoming *e*-mails.

5. Conclusions

The access method of Internet has been rapidly shifting from traditional dial-up modem access to the high-speed access using new technology such as ADSL. As indicated by our sampled data that were collected from Korea nationwide, most of the active Internet activities are incurred by those who subscribe to the high-speed information and telecommunication network. In a way to reflect such current Internet access environment and differentiate from existing researches in the area of Internet service, this study analyzed the high-speed Internet network users only.

Hypotheses testing results show that the set of gender, age, Internet usage, service kinds, incoming *e*-mails, and *e*-shopping is statistically significantly influencing 11 aspects of user's dissatisfaction with respect to Internet service. Among these independent variables, age has the vast impact on the dissatisfaction level. Besides, gender and *e*-shopping are considered to be the next explanatory variables. Older group feel more dissatisfied with all aspects of internet service. Female users seem to be more meticulous about internet service in general. For telecommunication policy makers and business leaders, it might be worthwhile to invest more effort in making older and female users feel happy about every day internet-related activities. The investment can be realized in many forms, e.g., more user-friendly environment and operation, easier quest for information and knowledge, more secure online transaction and protection from hazard.

A further study might include the analysis of paradigm shift in user behavior patterns between the traditional modem access environment and the high-speed network triggered by the advancement of network technology. It would also be valuable to study on similarities and differences in the high-speed wireless Internet services and wired ones.

References

[1] Byun, J.H, "Analysis of Recent Internet Usage in Korea," *Analysis of Electronic and Telecommunication Trends*, Vol.16, No.6(Dec. 2001).

[2] Cohen, W.W., "Learning Rules That Classify E-mail," In proceedings of the 1996 AAAI Spring Symposium on Machine Learning in Information Access, 1996.

[3] Dellaert B., and B., Kahn, "How tolerable is delay?, Consumers' Evaluations of Internet Web Sites After Waiting," *E-commerce Research Forum*, Vol.1, No.1(1999).

[4] Doherty, N.F., F. Ellis-Chadwick, and C.A., Hart, "Cyber Retailing in the UK : the Po-

tential of the Internet as a Retail Channel," *International Journal of Retail and Distribution Management*, Vol.27, No.1(1999), pp.22-36.

[5] Donthu, N., and A. Garcia, "The Internet Shopper," *Journal of Advertising Research*, May/June 1999, pp.52-58.

[6] International Telecommunication Union (ITU), "The Republic of Korea's Success with ADSL," *ITU News*, No.6(2001).

[7] Korea Ministry of Information and Communication, Statistical Data of Sept. 2001.

[8] Liao, Z., and M.T., Cheung, "Internet-Based E-shopping and Consumer Attitude : An Empirical Study," *Information & Management*, 38(2001), pp.299-306.

[9] Lynch, J., and D. Ariely, "Electronic Shopping for Wine : How Search Costs for Information on Price, Quality, and Store Comparison Affect Consumer Price Sensitivity, Satisfaction with Merchandise, and Retention," *E-commerce Research Forum*, 1999.

[10] Phau, I., And S.M., Poon, "Factors Influencing the Types of Products and Services Purchased Over the Internet," *Internet Research : Electronic Networking Applications and Policy*, Vol.10, No.2(2000), pp. 102-113.

[11] Sahami, M., S. Dumais, D. Heckerman, and E. Horvitz, "A Bayesian Approach to Filtering Junk E-mail," AAAI '98 workshop on Learning for Text Categorization, Madison, Wisconsin, 1998.

[12] Spertus, E., "Smokey : Automatic Recognition of Hostile Messages," In proceedings of innovative applications of Artificial Intelligence (IAAI), 1997, pp.1058-1065.

[13] Tan, S.J., "Strategies for Reducing Consumers' Risk Aversion in Internet Shopping," *Journal of Consumer Marketing*, Vol.16, No.2(1999), pp.163-180.

[14] Zeithaml, V.A., L.L. Berry, and P. Parasuraman, Delivering Quality Service : Balancing Customer Perceptions and Expectations, New York : Free Press, 1990.