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Electronic Commerce Research and Applications 6 (2007) 425–432

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**Electronic  
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# A structural equation modeling of the Internet acceptance in Korea

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Received 15 March 2005; received in revised form 29 August 2006; accepted 29 August 2006

Available online 21 December 2006

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## Abstract

The objective of this study is to develop and test an integrated conceptual model of the Internet acceptance. Based on the two dominant theoretical paradigms – the theory of reasoned action (TRA) and the technology acceptance model (TAM) – we propose a model of the Internet acceptance to investigate the relationship between external variables such as individual differences, task characteristics and management support, and individual acceptance of the Internet. The model is tested using data gathered from 374 end users of the Internet in Korean firms and data analysis is conducted using a structural equation modeling with LISREL. Significant relationships are found between experience and usefulness, between experience and ease of use, and between ease of use and usefulness. Organizational support is found to influence usefulness, ease of use and subjective norm. We also observe that actual usage is not influenced by subjective norm, but significantly influenced by experience, usefulness and ease of use. This result implies that individual acceptance of the Internet is significantly related to external factors such as experience, task characteristics and organizational characteristics rather than beliefs. © 2006 Elsevier B.V. All rights reserved.

*Keywords:* Internet acceptance; Technology acceptance model; Self-efficacy; Experience; Task characteristic; Organizational support

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## 1. Introduction

Over the past several decades, researchers and practitioners have tried to evaluate the success and failure of the information systems. However, research findings are diverse and sometimes contradictory to each other. Technology acceptance is a research area that examines a variety of different behaviors of end users confronted with new information technologies. Individual acceptance of information technology has been studied from diverse theoretical paradigms such as the theory of reasoned action (TRA), the theory of planned behavior (TPB), diffusion of innovation (DOI) theory, and social cognitive theory (SCT) [1].

The explosive growth of the Internet is a revolutionary phenomenon. The Internet is one of the most important tools of the new century and has become the fastest growing mechanism for electronic markets by providing substantial market potential and offering a new channel to communicate with each other. In this study, we analyze the determinants of individual use of the Internet and the user's perceptions of the Internet in organizations by applying TRA and the technology acceptance model (TAM) [2–13]. TAM has been widely used to predict the acceptance of a new technology such as individual acceptance of information technology (IT). Although several researchers have modified TAM and extended its application to Internet arena [14–16], the research on the usage behavior in the Internet environment is premature yet. It is not clear as to what external variables would affect the usage behavior and intentions of individual IT users [17].

In 2003, the high-speed Internet adoption rate of Korea is 74%, which is the No. 1 in the world [58]. Among OECD countries, Korea has the highest installation rate of

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broadband Internet infrastructure [59]. Since Korea shows the top level in Internet infrastructure and Internet usage in the world, the study on the Internet acceptance in Korea has its importance and significance.

The rest of this article is organized as follows: Section 2 presents the theoretical background, Section 3 discusses research model and hypotheses, Section 4 reports the data analysis of the survey, and Section 5 summarizes the results of this study.

## 2. Theoretical background

### 2.1. TRA and TAM

The theory of reasoned action (TRA) is formulated as generalized explanations of a broad range of individual behaviors. The theory, originating from social psychology, states that attitude and subjective norms are the two typical determinants of behavioral intention that define behavior [18]. Attitude and subjective norms of individual are affected by beliefs and other external factors. TRA has been empirically tested and many studies have provided support for the predictive power of the model in the context of acceptance of IT [19] as well as marketing and sociology [1].

Davis [2,3] proposed the technology acceptance model (TAM) based on TRA. TAM specifies usefulness and ease of use as beliefs that determine attitude towards IT and actual system use. However, TAM does not include the subjective norms in TRA because of its uncertain status as a theoretical and psychometric construct [20]. TAM is used to evaluate information systems at the early stage of their development and to predict end user reactions to various information systems [21]. Many researchers have conducted empirical studies to examine the explanatory power of the TAM and it yields relatively consistent result on the acceptance behavior of IT end users [22–28].

Recently, several studies have investigated various factors affecting usage of the Internet and World Wide Web. Few studies on the Internet have adopted TAM as their research framework. Some have adopted the Triandis model as a reference theoretical model [29,30]. The Triandis model of choice proposes that the probability of performing an act is determined by a function of habits, facilitating conditions, and intention to perform the act [31]. The facilitating conditions refer to the objective factors in the environment. These conditions are very important since no behavior will occur when some objective obstacles exist. Research findings demonstrate that perceived usefulness and perceived ease of use have some effects on usage behavior of the Internet [14,16] and the facilitating conditions such as support provided by a company and accessibility to the Internet are one of the most important factors affecting the Internet usage [30].

Our study in this paper intends to find the relationship between the Internet use and the organizational variables through analyzing the Internet usage behavior of the work-

ing people in enterprises rather than individual behavior for a personal use. The personal use of the Internet is determined by an autonomous decision of a person, but the use of the Internet in an organization will be affected by the organizational variables such as tasks as well as the personal variables.

### 2.2. External variables

Dishaw and Strong [32] point out that one of the weaknesses of TAM in understanding IT acceptance is its lack of task focus. Other researchers articulate that TAM considers IS (information systems) to be an independent issue in organizational dynamics [33]. Recently, it has been suggested that significant factors are not included in TAM [33]. TAM postulates that external variables intervene indirectly by influencing perceived ease of use and perceived usefulness constructs. External variables considered in other studies on the individual acceptance of IT include situational involvement and intrinsic involvement [34], computing training and management support [24], level of education and prior experience [35], and task technology fit and task characteristics [32]. Therefore, to increase the external validity of the TAM and to understand better what influences perceived usefulness and perceived ease of use, it is necessary to include other significant factors.

Since 1990, many studies have extended the TAM model by adding external variables into the model. The external variables may be selected according to the technology features, research situation, and research aim etc. This paper is a study on the Internet acceptance by enterprise employees rather than by independent individuals. The external variables in this study can be classified into individual factors (e.g., experience and self-efficacy), task factors (e.g., task equivocality and task interdependence), and organization factors (e.g., organizational support). The individual factors are necessary because the acceptance of the Internet is an individual decision. The task factors are selected because an acceptance of a specific information technology in an organization has a strong relationship with task characteristics. The organization factors are selected for reflecting the support and promotion of the organization in the acceptance of the Internet.

## 3. Research model and hypotheses

### 3.1. Research model

We propose an integrated model of the Internet acceptance based on the TRA and TAM. Fig. 1 depicts the research model and illustrates the hypotheses tested. The individual characteristics have been reported to play an important role in the eventual success of information systems [36]. The acceptance of computer technology depends on the technology itself and the level of skill or expertise of the individual using the technology [37]. User training and experience, which represents individual skills

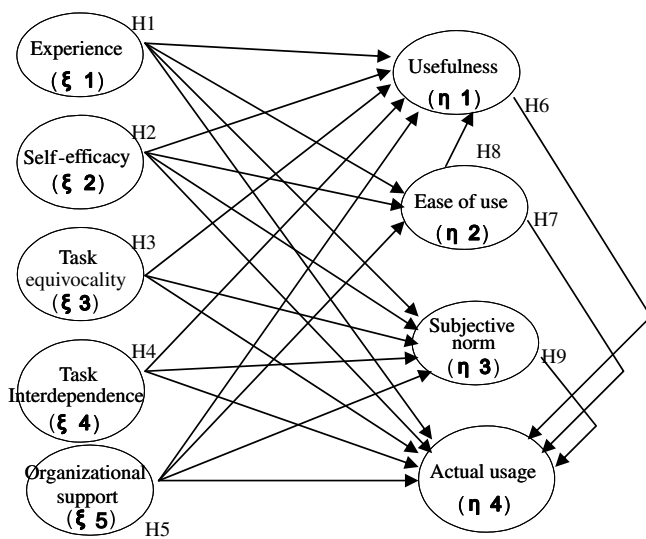


Fig. 1. Overview of the research model.

and expertise, are found to be related to user beliefs and usage. Opportunities to gain experiences using computers and information systems are thought to improve user's beliefs about the system [38,39]. Computer experiences are also found to be positively related to system usage [40,41]. Self-efficacy, the belief that one has a capability to perform a particular behavior, is an important construct in social psychology [42]. Self-efficacy perceptions have been predicted to be a significant precursor to computer use and its effect on outcome expectancy [43] has been supported [44,45].

As explained in the above, it is believed that individual characteristics will directly and indirectly affect usage through beliefs. Specifically in this research, we propose that experience and self-efficacy on the Internet will be positively associated with beliefs on the Internet and its usage.

In the original TAM model, the variables such as intention and attitude mediate the perceived usefulness and perceived ease of use to influence the technology acceptance. However, in the situation where a longitudinal study is difficult to perform, many studies choose either the intention to use or the actual use as the dependent variable. Since the intention to use is a prediction for a future and has a lower accuracy than the actual use, the intention variable has been dropped in some TAM researches. The attitude variable also has been dropped because the attitude cannot be a direct independent variable or a full mediating variable. In our study, the two mediating variables were dropped for simplifying the model.

**Hypothesis 1.** The Internet experience will directly influence perceived usefulness, perceived ease of use, subjective norm, and actual usage of the Internet.

**Hypothesis 2.** The Internet self-efficacy will directly influence perceived usefulness, perceived ease of use, subjective norm, and actual usage of the Internet.

One of the problems in applying TAM is that its constructs do not fully reflect the various task environment of users. IT is a tool by which users accomplish organizational tasks. The lack of task focus in evaluating IT and its acceptance, use, and performance might have resulted in the mixed results. While TAM's usefulness concept implicitly include task, more explicit inclusion of task characteristics will provide a better understanding on IT utilization [32].

Task characteristics and their impact on information systems have been studied in [46,47,38,37]. According to the previous researches, task uncertainty and task interdependence affect the usage of and the attitude to information technology. Therefore, we build hypotheses about the effect of task equivocality and interdependence on the acceptance on the Internet. However, the paths between task characteristics and the perceived ease of use are omitted as seen in Fig. 1 because it is not plausible that the task characteristics affect the perceived ease of use of Internet.

**Hypothesis 3.** Task equivocality will directly influence perceived usefulness, subjective norm, and actual usage of the Internet.

**Hypothesis 4.** Task interdependence will directly influence perceived usefulness, subjective norm, and actual usage of the Internet.

Organizational support is considered to be directly related to system usage [48,49]. Organizational support is found to be associated with favorable beliefs and with greater system usage [40,41,24]. Lack of organizational support is considered as a critical barrier to the effective utilization of computers [38]. Therefore, organizational support is expected to have positive influence on beliefs about and user acceptance of the Internet.

**Hypothesis 5.** Organizational support will directly influence perceived usefulness, perceived ease of use, subjective norm, and actual usage of the Internet.

TAM posits that the two constructs, perceived usefulness and perceived ease of use, mediate all the external variables likely to influence an individual's decision to use an information system. Many literatures relating to IT acceptance report that perceived usefulness is positively related to system usage and that perceived ease of use is directly and indirectly related to behavior through its effect on perceived usefulness.

**Hypothesis 6.** Perceived usefulness will affect actual usage of the Internet.

**Hypothesis 7.**

Perceived ease of use will affect actual usage of the Internet.

**Hypothesis 8.** Perceived ease of use will affect perceived usefulness.

Subjective norm, along with attitude, accounts for intention to perform a behavior in TRA. However, in TAM, the subjective norm construct has not been significant [20,50]. One possible explanation is the use of students as respondents in many tests of TAM. Subjective norm is expected to be more important in an organizational setting [19]. We have data from an organizational setting, where users may feel some social pressure to use the Internet, therefore we try to test the significance of subjective norm. Though subjective norm is called a different name (i.e., social factor, social pressure), it is regarded as an important factor that influences usage behavior in previous researches [48,41,51].

**Hypothesis 9.** Subjective norm will affect actual usage of the Internet.

3.2. Definition and measurement of research variables

We examined the following nine proposed determinants of the Internet acceptance: the Internet experience, the Internet self-efficacy, task equivocality, task interdependence, organizational support, perceived usefulness, perceived ease of use, subjective norm, and actual usage. In our study, the Internet acceptance means the individual use of Internet as an end user in a business organization. Most of the variables included in the research model,

Table 1  
Measurement of research variables

Variables	Measurement Items	References
Experience	<ul style="list-style-type: none"> <li>• Using experience of chatting</li> <li>• Using experience of e-mail</li> <li>• Using experience of game and entertainment</li> <li>• Using experience of shopping mall</li> <li>• Using experience of news and information searching</li> <li>• Using experience of others</li> </ul>	[52]
Self-efficacy	<ul style="list-style-type: none"> <li>• If there was no one around to tell me what to do as I use</li> <li>• If I had never used the Internet services like it before</li> <li>• If I had only the Internet services manuals for reference</li> <li>• If I had seen someone else using it before trying it myself</li> <li>• If I could call someone for help if I got stuck</li> <li>• If someone else had helped me get used</li> <li>• If I had a lot of time to complete the job for which the Internet services were provided</li> <li>• If I had just the built-in help facility for assistance</li> <li>• If someone showed me how to do it first</li> <li>• If I had used similar the Internet services before this one to do the same job</li> </ul>	[48]
Task equivocality	<ul style="list-style-type: none"> <li>• I frequently deal with ill-defined business problems</li> <li>• I frequently deal with ad-hoc, non-routine business problems</li> <li>• Frequently the business problems I work on involve answering questions that have never been asked in quite that form before</li> </ul>	[47]
Task interdependence	<ul style="list-style-type: none"> <li>• The business problems I deal with frequently involve more than on business function</li> <li>• The problems I deal with frequently involve more than on business function</li> </ul>	[46]
Organizational support	<ul style="list-style-type: none"> <li>• I am always supported and encouraged by my boss to use the computers in the performance of my job</li> <li>• Management has provided most of the necessary help and resources to get us used to the computers quickly</li> <li>• A central support (e.g. information center) is available to help with problems</li> <li>• Training courses are readily available for us to improve ourselves in the use of computers</li> </ul>	[38,53]
Perceived usefulness	<ul style="list-style-type: none"> <li>• Using internet in my job would enable me to accomplish tasks more quickly</li> <li>• Using internet in my job would improve my job performance</li> <li>• Using internet in my job would increase my productivity</li> <li>• Using internet in my job would enhance my effectiveness on the job</li> <li>• Using internet in my job would make it easier to do my job</li> <li>• I would find internet useful in my job</li> </ul>	[2,3]
Perceived ease of use	<ul style="list-style-type: none"> <li>• Learning to operate internet would be easy for me</li> <li>• I would find it easy to get internet to do what I want it to do</li> <li>• My interaction with internet would be clear and understandable</li> <li>• I would find internet to be flexible to interact with</li> <li>• It would be easy for me to become skillful at using internet</li> <li>• I would find internet easy to use</li> </ul>	[2,3]
Subjective norm	<ul style="list-style-type: none"> <li>• Supporting level of internet usage</li> <li>• I think that those people who are important to me would want me to use the internet</li> </ul>	[18,50]
Actual usage	<ul style="list-style-type: none"> <li>• Usage frequency</li> <li>• Usage times (min)</li> </ul>	[3,20]

drawn from previous studies as summarized in Table 1, proved to be reliable and valid. For example, Clemente [52] proposes six types of Internet services such as chatting, email, game and entertainment, shopping, news and information search, and miscellaneous use and we also adopt the classification in measuring the Internet experience. Some of the variables such as experience and self-efficacy were modified to fit into our study. Among the 10 measurements used for measuring computer self-efficacy in Compeau and Higgins's study [48], the six ones are modified and the four ones are reused for the Internet self-efficacy measurements. All variables except actual usage are measured by Likert (7-point) perceptual scale.

For the reliable measurement of research variables, many studies have used more than two measurements for each research variable. In our study, we use only the two measurements for the task interdependence and the subjective norm. However, there have been some researches using the less than three measurements for the task interdependence [46,47,54] and the subjective norm [3,18,19,41,50,55].

#### 4. Analysis of research results

##### 4.1. Demographic characteristics

The unit of analysis in this research is the individual user of the Internet in organizations. The data collected from a structured questionnaire were used to test the proposed hypotheses. Four hundred and nine questionnaires were received among the 600 distributed to the employees of 10 companies of five industries such as system integration, electronics, construction, manufacturing, and government-owned enterprises. We used quota sampling because random sampling is impossible in our research design. In order to avoid a bias to a specific industry, we selected the five industries and allocate fifty questionnaires to the two companies per industry. Incompletely answered questionnaires were discarded from the data analysis.

The sampling procedure consists of pre-survey, questionnaire revision, and main survey. The pre-survey has been carried out with a system integration company and an electronics company. The questionnaire was revised according to the results of the pre-survey. To improve the response rate, we allocate a delegate in each company, who distributes and gathers questionnaires, and give stationary present to respondents.

Table 2 summarizes the demographic characteristics of the respondents. The distribution of respondents' gender, age, education, tasks, work experience, department, and industry is typical and not much different from that of average employees of Korean companies, which confirms the representativeness of the sample.

##### 4.2. Analyses of measures

Empirical exploratory factor analysis (EFA) and reliability analysis confirm the reliability and validity of vari-

Table 2  
Demographic information of respondents

Classification		Number (374)
Gender	Male	328
	Female	46
Age	Under 30	111
	30–39	223
	40–49	36
	Over 50	4
Educational level	High school graduate	33
	Special college/bachelor	318
	Master/doctorate	23
Work experience	Under 1 year	39
	2–4	106
	5–7	92
	8–10	68
	Over 11 years	69
Department	Manufacturing	47
	Marketing	76
	General management	127
	IS	78
	R&D	46
Industry	Computing	73
	Electronics	65
	Manufacturing	88
	Construction	83
	Public service	65

ables adopted in this study. The reliability of all instruments assessed by the Cronbach's  $\alpha$  reliability coefficient are above the conventional level of 0.7 [56] as shown in Table 3. Confirmatory factor analysis (CFA) demonstrates the unidimensionality, convergent and discriminant validity of the multi-item measures of each construct as displayed in Table 4.

##### 4.3. Tests of hypotheses

The model proposed in the study was tested with structural equation modeling using LISREL. To assess the model, multiple fit indices were computed. The data were generally consistent with our hypothesized structure. The fit statistics, GFI(0.90), AFGI(0.87), RMR(0.049), NFI(0.91), NNFI(0.93), CFI(0.94) were all indicative of good fit. Fig. 2 presents the final model with the non-significant paths removed.

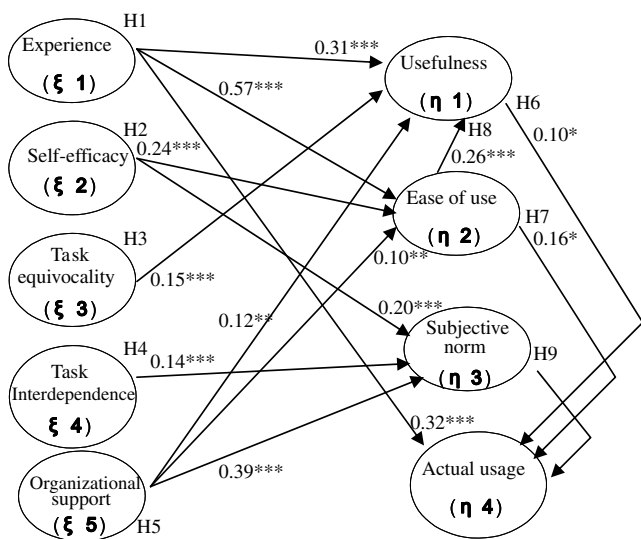
Table 3  
Reliability test

Variable	Cronbach's $\alpha$	Number of items
The Internet experience	0.8146	6
The Internet self-efficacy	0.8848	8
Task equivocality	0.8120	3
Task interdependence	0.8242	2
Organizational support	0.8633	4
Perceived usefulness	0.9604	6
Perceived ease of use	0.8553	6
Subjective norm	0.8430	2

Table 4  
Confirmatory factor analysis of each variable with more than 2 items

Variables	Items	Factor loading ( <i>t</i> -value)	Reliability of a scale	Portion of the variance extracted
The Internet experience	X1	0.44 (8.38)	0.7754	0.4794
	X2	0.57 (11.32)		
	X3	0.80 (17.57)		
	X4	0.87 (19.57)		
The Internet self-efficacy	X5	0.82 (17.27)	0.8087	0.5868
	X6	0.80 (16.73)		
	X7	0.67 (13.52)		
Task equivocality	X8	0.78 (16.66)	0.8468	0.6485
	X9	0.83 (18.26)		
	X10	0.80 (17.22)		
Task interdependence	X11	0.86 (18.94)	0.8842	0.7952
	X12	0.77 (14.67)		
Organizational support	X13	0.87 (20.13)	0.8798	0.7115
	X14	0.92 (22.09)		
	X15	0.74 (16.17)		
	X16	0.72 (15.64)		
Perceived usefulness	Y1	0.92 (23.21)	0.9377	0.8341
	Y2	0.96 (24.90)		
	Y3	0.85 (20.31)		
Perceived ease of use	Y4	0.86 (18.74)	0.7463	0.5118
	Y5	0.44 (8.29)		
	Y6	0.78 (16.45)		
Subjective norm	Y7	0.93 (20.75)	0.8890	0.8004
	Y8	0.86 (18.53)		

$\chi^2(p) = 499.24 (0.0)$ , GFI = 0.91, AGFI = 0.87, RMSR = 0.044, NFI = 0.91.



\*\*\*:  $p < 0.01$ , \*\*:  $p < 0.05$ , \*:  $p < 0.1$

Fig. 2. Path coefficients for full model.

The results of the multivariate test of the structural model shows that the model as a whole explained 26% of the variance in the Internet usage. The explained variance in perceived usefulness, perceived ease of use, subjective norm was 42%, 56%, 33%, respectively.

The Internet experience was positively related to perceived usefulness, perceived ease of use, and actual usage.

The Internet self-efficacy significantly predicted perceived ease of use and subjective norm. Task equivocality had direct effect on perceived usefulness and task interdependence influenced the subjective norm. In addition, the data confirmed the importance of the organizational support in influencing perceived usefulness, perceived ease of use, and subjective norm. These results provided partial support for hypotheses H1, H2, H3, H4, and H5. Perceived usefulness, as expected, was significantly and positively related to the Internet use (H6). There was also support for H8 and H7 indicating that ease of use is positively related to perceived usefulness and the Internet use. But subjective norm did not have any effect on the Internet use. Thus, hypotheses H6, H7, and H8 were supported but hypothesis H9 was rejected.

One thing to note is that the relationship between self-efficacy and subjective norm was significant with significance level 0.01. It means that a person with high confidence in Internet use perceives higher expectation from the people around her or him. Actually, people have high expectation towards the person with high confidence in an information technology on the use of the technology.

### 5. Conclusion and limitations

In this study, we have developed and tested a conceptual model of the Internet acceptance. Perceived usefulness and perceived ease of use are found to be useful in predicting

the usage behavior of the Internet whereas the subjective norm is not significant to the Internet usage for this study. Results from our study uncover several implications for future research and practice.

First, experience, self-efficacy and organizational support were significantly correlated with perceived ease of use. This is consistent with previous researches in IS domain. To enhance the perception of ease of use, managers should provide to end users with organizational support for using a new information technology.

Second, perceived usefulness and perceived ease of use affected the usage of the Internet. Both usefulness and ease of use are believed to be important factors in determining the acceptance of information technologies in previous studies. Since ease of use cannot fully compensate for low usefulness, system developers must put a considerable amount of emphasis on usefulness.

Third, subjective norm has little effect on the actual usage of the Internet and this is consistent with previous research such as [20,50], but not consistent with Cheung et al. [30]. Given these conflicting results, more research remains to be done to explore the precise role of social pressure in this area.

Korea records the highest ranks in the broadband Internet diffusion and Internet usage in the world wide. Korean people who have seen the high-speed economic growth demand agility in everything and are very active in the use of the various Internet functionality. This study shows that the Internet experience affects the actual usage as well as the usefulness and the ease of use. People initially have a fear of using the various functionality of the Internet. However, once they use it, the fear on the new technology disappears and the usage becomes higher and higher. Since Korean people could easily experience the Internet though the broadband Internet infrastructure and quick response to change, such an easy access to Internet and the experience became the major factor for the high Internet usage.

Subjective norm has been a special interest in this study since Korean people are known to be sensitive to other people's opinions and expectations. The analysis result shows that the self-efficacy, task interdependence, and organizational support affect the subjective norm, which means that the people with higher confidence in Internet, higher task interdependence with other people, and higher organizational support perceive higher expectation in the Internet usage from other people. However, it is interesting to see that the subjective norm does not have significant relationship with the actual Internet usage.

This study has several limitations as an empirical study. First, use of self-reported usage by workers implies that there may be some possibility of a common bias in the results of the study. Therefore, more efforts should be exerted on collecting data by observing behaviors. For example, Horton et al. [57] demonstrates that self-report and actual measures of intranet usage are not interchangeable when applying their technology acceptance model.

Second, our study depends on a cross-sectional survey of respondents through structured questionnaires. Legris et al. [33] suggested that the influence of some factors on the intention of using information technology varies at different stages in the implementation process. A longitudinal study would be more informative to investigate the problem of individual acceptance of information technologies. Third, the relevance of certain constructs in our model may be scrutinized carefully in the future. Individual differences, social influences, and situational influences are worth to be revisited. Finally, the individual use of the Internet in Korean enterprises is very active due to the strong infrastructure and seems to be relatively free comparing with in other countries. Employee may use the Internet for a personal purpose as well as organizational purpose. Our sample will have both the generality and the limitation as the representation of a relatively free Internet usage culture in organization.

### Acknowledgements

This research is supported by the Ubiquitous Automatic Computing and Network Project, the Ministry of Information and Communication (MIC) 21st Century Frontier R&D Program in Korea.

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