

기술수용모델(TAM)과 계획된 행동이론(TPB)을 바탕으로 한 모바일 기술수용에 대한 실증적 연구

An Empirical Study on Mobile Technology Adoption based on the Technology Acceptance Model and Theory of Planned Behavior

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요 약

정보통신기술의 수용에 대한 많은 선행연구들은 기술수용이 유용성(usefulness), 사용의 용이성(ease of use) 그리고 기술에 대한 자긍심(self-efficacy) 같은 혁신적 요인에 의해 영향을 받는다고 하였다. 그러나, 이러한 선행연구들은 사회적 규범(subjective norms), 구전효과(word-of-mouth) 그리고 광고(advertising)와 같은 모방적 요인에 대해서는 간과해 왔다. 특히 수요대폭발(critical mass)을 불러 일으키는 모방적 요인과 혁신적 요인의 상호간 인과관계에 대한 연구는 그다지 활발하지 않았다. 그래서 본 연구는 모바일 기술의 수용에 있어 모방적 요인의 역할에 대해 초점을 맞추었다. 이 연구의 목적은 통합적 관점에서 초기 모바일 기술 수용에 대한 의도에 영향을 미치는 요인들간의 인과관계를 실증적으로 검증하였다. 그 결과, 대량광고, 구전효과와 사회적 규범과 같은 모방적 요인이 모바일 수용의도에 직/간접적으로 영향을 미치고 있다는 것을 밝혔다. 본 연구는 기술 전파에 따른 시장변화에 있어 정보통신 장비공급업체에게 효과적으로 대응할 수 있는 전략수립에 도움을 주리라 믿는다.

키워드 : 기술수용모델, 모방적 요인, 혁신적 요인

I. Introduction

1.1 Background of the Problem

Electronic commerce and telecommunication technologies have impacted businesses enormously in the last few years, as more and more people are beginning to enjoy the benefits of information and communication technology (ICT). ICT provides end-users with the ability to retain control of their dispersed assets and afford flexi-

bility that may prove to be cost effective through a wide array of devices and operating systems. Some people, however, are still very reluctant to adopt ICT because of the technological challenges, security concerns, and uncertainty of value added (Turban and King, 2003). Some of the technological challenges are as follows:

- (1) The user interface of wireless devices is quite limited and cannot display information-rich content in a useful way (this is also a market-

- ing chance for technology vendors to solve this problem),
- (2) The present devices have fairly limited capabilities for processing and storing information and data compared with PCs (this will not be a big constraint in the future considering the explosive development of chip technology), and
 - (3) The bandwidth of wireless devices is a huge limitation to mobile commerce application development (Kannan, *et al.*, 2001).

Recently, ICT has revolutionized the business world as witnessed by the same way that e-commerce has done over the last several years. Repurchasing intentions of mobile technology device users, however, are not a sure thing. Therefore, the preceding evidence regarding ICT has prompted many manufacturers of mobile phones to improve and redesign their voice quality, ease of use, playfulness, and design quality (Liu and Arnett, 2000; Wan, 2000) of their associated devices as well as attempting to understand the growing number of customer needs (Kalakota and Whinston, 1997), product perceptions, purchasing experiences, and customer service (Jarvenpaa and Todd, 1997). Palmer and Griffith (1998) proposed that a change is needed for manufacturers of mobile phones not only to concentrate on the technological characteristics of ICT, but also to address customer concerns and contents (Jarvenpaa and Todd, 1997).

Even though previous ICT studies have articulated consumer behavior of IT acceptance, their foci were separate from consumer characteristics or product characteristics. The willingness of customers to use ICT needs to be considered to-

gether with technology, products or services, social, and human factors under high uncertainty (De Meyer *et al.*, 2002). In ICT adoption, technology determinants may lead consumers to engage in information system usage, while marketing determinants may increase repeat repurchasing behavior. Smith and Sivakumar (2002) explored conditions under which different dimensions of ICT adoption behaviors, consumer related factors, the nature of the product, and the nature of the purchase occasion influence user behavior.

DeCanio *et al.* (2000) suggested that organizational structure affects both the situation of individuals and subunits within organizations. Legris *et al.* (2003) concluded that the Technology Acceptance Model (TAM) is useful, but it should be integrated into a broader model, which would include variables related to both human and social change. Therefore, this study attempts to provide a new direction for strategies of adopting and diffusing ICT to manufacturers of mobile phones and content developers by examining mobile phone user behavior patterns related to ICT adoption and imitation behaviors.

1.2 Research Purpose

The overall objective of this study is to understand the process of mobile technology diffusion among end users so as to effectively implement adoption and cope with frequent changes in the environment. In the mobile devices market, the rapid development of new contents, such as movie transmissions and digital photo transmissions makes existing mobile phones difficult to cope with all new functions. Thus, it seems apparent that the manufacturers of mobile phone should

enhance their efforts to develop more up-to-date technology (Grover *et al.*, 1993). Despite impressive advances in the ICT field, it is true that many ICT manufacturers are still wondering which factors are important in customer adoption of new technology. This study proposes to investigate the relationship between the initial acceptance factors, such as innovation influence and imitation influence.

In this study, we develop an ICT adoption model to determine the relationships among **the social interaction dimension** based on subjective norm (Ajzen and Fishbein, 1980; Taylor and Todd, 1995), word-of-mouth (Cisek, 1993; Lee, 2003a; Silverman, 2001) and advertising (Vaughn, 1980, 1986; Rossiter and Percy, 1987), **the individual perception dimension** based on theory of planned behavior (TPB: Ajzen and Fishbein, 1980), **and the technology acceptance dimension** based on TAM (Davis, 1989; Davis *et al.*, 1989) and self-efficacy (SE: Bandura, 1982; Klein, 1998; Compeau and Higgins, 1995a-b, Compeau *et al.*, 1999) in the initial ICT adoption.

II. Literature Review

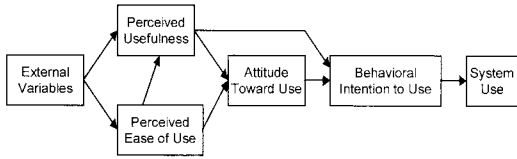
Initial acceptance models in this study, are based on the aspects of technical (Ajzen and Fishbein, 1980; Davis, 1989; Davis *et al.*, 1989), social (Bearden *et al.*, 1986; Burnkrant and Cousineau, 1975; Handelman and Arnold, 1999), motivation (Compeau *et al.*, 1999; Currall and Judge, 1995; McKnight *et al.*, 1998), and marketing dimensions (Rayport and Sviokla, 1994).

2.1 Technology Dimension

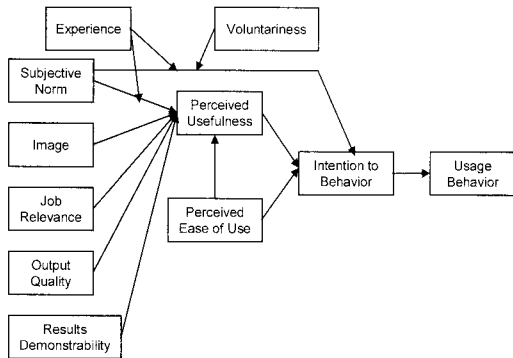
Theories of information system (IS) use have

been examined through TRA (Theory of Reasoned Action) and TPB (Theory of Planned Behavior), which have proven to be successful in predicting and explaining behavior across business areas (Adams *et al.*, 1992; Agarwal and Prasad, 1997; Christensen, 1987; Davis, 1989 and 1993; Mathieson, 1991; Moore and Benbasat, 1996; Pavri, 1988; Sheppard *et al.*, 1988; Taylor and Todd, 1995; Thompson *et al.*, 1991). Based on TRA, Davis (1989) introduced TAM which provided an explanation of the determinants of computer acceptance by end users (Chau, 1996; Hu *et al.*, 1999; Sznjna, 1996; Venkatesh and Davis, 1996 and 2000). TAM theorizes that perceived usefulness and perceived ease of use determine actual intention and usage behavior as shown in <Figure 1> (Davis 1989). While TAM initially focused on system usage in the workplace, recent research has successfully employed TAM to understand Internet use (Teo, *et al.*, 1997). Some researchers (Mathieson, 1991; Taylor and Todd, 1995), however, criticize TAM because TAM did not explicitly consider any social variables. Based on this criticism, Venkatraman (2000) and Venkatraman and Davis (2000) tried to develop the Extension of Technology Acceptance Model (TAM2) which extends TAM by showing that subjective norm, image, job relevance, output quality and results demonstrability significantly influence perceived usefulness as shown in <Figure 2>. Specifically, subjective norm exerts a significant direct effect on usage intention over and above the perceived usefulness and perceived ease of use for mandatory systems but not voluntary systems. That is, people incorporate social influences into their own usefulness perception and identification, in which people use a system to gain status and influence

within their work group, and thereby improve their job performance.



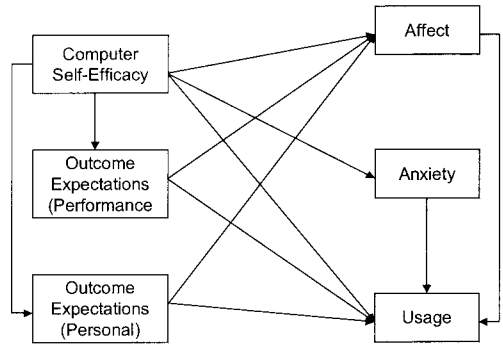
<Figure 1> The Technology Acceptance Model (TAM)



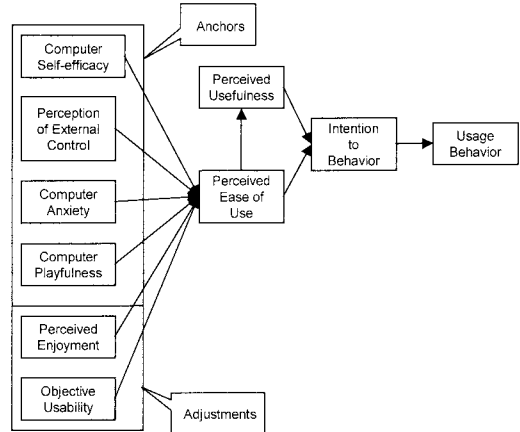
<Figure 2> The Extension of Technology Acceptance Model (TAM2)

2.2 Motivation Dimension

In an electronic learning environment, individuals who are comfortable with technology may have positive attitudes. The concept of self-efficacy has been incorporated into IS research on technology adoption and use (Compeau and Higgins, 1995a-b). It has also made its way into the literature through TPB (Ajzen, 1985), which considers perceived behavioral control and social norms as predictors of attitude (Mathieson, 1991). Compeau *et al.* (1999) showed that self-efficacy impacted an individual's affective and behavioral reactions to information technology as shown in <Figure 3>.



<Figure 3> Compeau *et al.*'s (1995a) Self-efficacy Mechanism on Individual Reactions



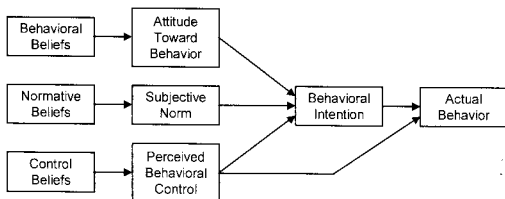
<Figure 4> Theoretical Model of Perceived Ease of Use as a Determinant of Technology Adoption

Venkatesh (2000) presented and tested an anchoring and adjustment based on a theoretical model of system-specific perceived ease of use as a determinant for technology adoption. His model proposed constructs related to control, intrinsic motivation, and emotion as general anchors for formation of perceived ease of use regarding a new system. With increasing end user experience, it is expected that system-specific perceived ease of use, while anchored to the general beliefs regarding computers and computer

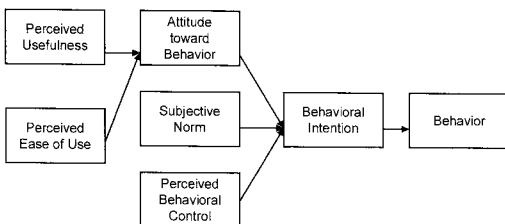
use, will adjust to reflect objective usability, and perceived enjoyment from system use that have an added influence on system-specific perceived ease of use as shown in <Figure 4>.

2.3 Social Dimension

The effects of social influence processes are consistent with TAM2 which is based on Theory of Planned Behavior (TPB). TPB is a well-established general theory of social psychology that asserts specific salient beliefs influence given behavioral perceptions and subsequent actual behavior (Ajzen, 1985, 1988 and 1991). There are three types of beliefs in TPB that impact three perceptual constructs: behavioral beliefs that influence attitudes, normative beliefs that affect subjective norm, and control beliefs that shape perceived behavioral control. In turn, these three perception constructs determine behavioral intentions and actual behavior, as depicted in <Figure 5> and <Figure 6>.



<Figure 5> Theory of Planned Behavior



<Figure 6> The Taylor and Todd Model on the Role of Prior Experience

On the other hand, according to institutional theory (Handelman and Arnold, 1999), the institutional environment contains taken-for-granted social and cultural meaning systems or norms that define social reality. Rogers (1976) insisted that social factors are closely related to the communication network aspects of diffusion of innovation theory (DIT), which lie at the heart of the diffusion process. There are two types of social influence: (1) informational influence, which occurs when individuals accept information as evidence of reality, and (2) normative influence, which occurs when individuals conform to the expectations of others (Bearden *et al.*, 1986; Burnkrant and Cousineau, 1975; Handelman and Arnold, 1999).

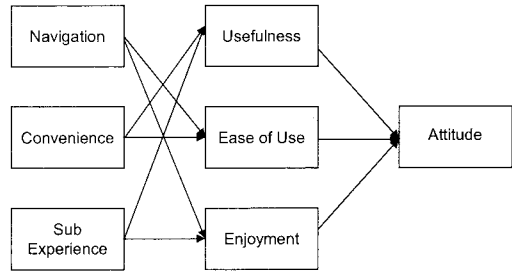
First, word-of-mouth (WOM) communications might be a highly important external variable. WOM messages may be a powerful determinant of the adoption of technology. Consumers were affected more by WOM messages than by any other factor overall according to Webster (1991). Based on prospect theory, several studies (Kahneman and Tversky, 1979; Aharony and Swary, 1980; Einhorn and Hogarth, 1981; Lang and Litzenberger, 1989; Michaely *et al.*, 1995) detect stronger effects when information about a product is unfavorable rather than favorable, and when information is verbal rather than written (Herr *et al.*, 1991). In addition, face-to-face WOM messages have proven to be powerful influences on consumer attitudes and behavior. Second, possible salient referents for the social normative component with respect to individual adoption of IT could be friends (Brancheau, 1987; Cale and Eriksen, 1994) and close peers of the potential adopter through their own personal interaction (Brancheau and Wetherbe, 1990).

2.4 Marketing Dimension

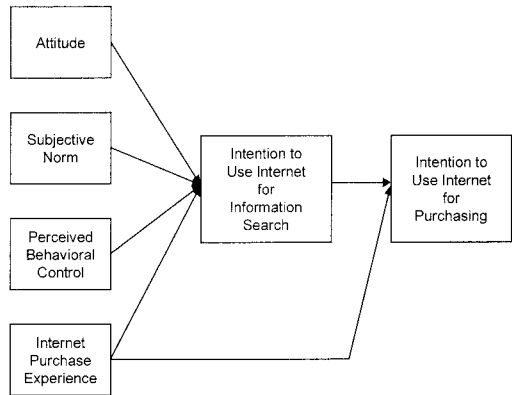
In the marketing area, an important question for advertisers is whether or not to match the advertising appeal to the consumer attitude. A well-known advertising planning model, Cone and Belding Advertising (FCB Grid: Vaughn, 1980, 1986) and the Rossiter-Percy Grid (Rossiter and Percy, 1987; Rositter *et al.*, 1991) dimensionalize attitudes in terms of whether they are based on affect or cognition. The FCB Grid discriminates between affect and cognition-based attitudes using a 'think-feel' dimension while the Rossiter-Percy Grid discriminates between affective and cognitive attitudes by analyzing the 'purchase motive which caused the attitude to form initially' (Rossiter and Percy, 1987; Rositter *et al.*, 1991).

Childers *et al.* (2001) insisted that navigation, convenience, and the sub-experience of the electronic environment to personally examining products were found to be important predictors of online shopping attitudes channeled through usefulness, ease of use and enjoyment as shown in <Figure 7>. Shim *et al.* (2001) also proposed and empirically tested their ideas in the context of goods search. They showed that intention to use the Internet to search for product information was not only the strongest predictor of Internet purchase intentions, but also mediated relationships between purchasing intentions and other predictors such as attitudes toward Internet shopping, perceived behavioral control, and previous Internet purchase experiences. In addition, they found direct and indirect relationships between antecedents such as attitude toward Internet shopping and previous Internet purchase experience, and Internet purchase intension as shown

in <Figure 8>.



<Figure 7> Childers *et al.*' Model for Online Retail Shopping Behavior



<Figure 8> Shim *et al.*'s Model for Predicting Online Purchase Intentions

Rayport and Sviokla (1994) developed a framework for managing customer behavior in the market-space. This framework shows that newspaper brand loyalty comes from content (i.e., news, business, sports, weather), context (format, organization, logo, editorial style, and rhetorical tone), and infrastructure (printing plant and physical distribution system).

In an Ernst & Young survey on e-commerce, 69 percent of respondents stated that brand names played a significant role in their online buying decisions. Online users continue to grav-

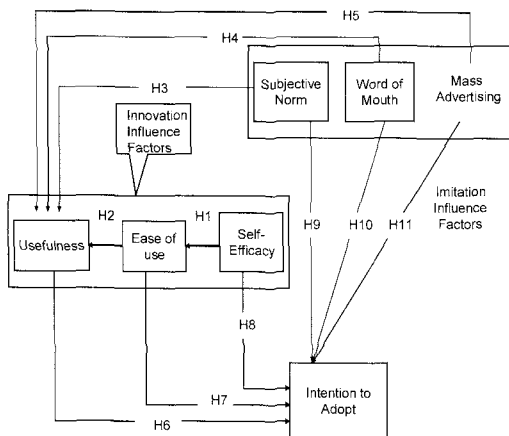
itate toward brands for two basic reasons: 1) brand names act as substitutes for information gathering by helping online buyers locate specific products and thus reduce search costs; and 2) consumer attitudes regarding brand trust, security, and expectations regarding product quality (Coltman *et al.*, 2002).

III. Research Model and Hypotheses

3.1 Research Model

The main purpose of this study is to investigate which and by how much innovation and imitation influences affect ICT adoption if mobile phone users' adoption intentions are affected by innovation and imitation characteristics.

The literature review suggests that technology, motivation, social, and market dimensions strongly affect end-user intentions based on TRA, TAM, TPB, DIT, WOM and advertising. The conceptual model supporting hypotheses is as shown in <Figure 9>.



<Figure 9> The Research Model for Hypotheses

3.2 Development of Hypotheses

3.2.1 H1 and H8: Self-efficacy (SE)

One characteristic of mobile phone adoption is related to computer self-efficacy. Self-efficacy means one's subjective judgment about his or her own work abilities. This does not mean one's specific skills but one's subjective judgment on whether he/she will be able to attain the required results (Bandura, 1977).

Venkatesh and Davis (1996) studied an antecedent and determinant of ease of use (EOU), and Venkatesh (2000) eventually developed his model in 2000. Venkatesh's latest model shows that ease of use is affected by computer self-efficacy, computer anxiety, computer playfulness, perceived enjoyment, and objective usability.

On the other hand, according to Fishbein and Ajzen (1975), SE is referred to as 'a person's subjective probability that he will perform some behavior to adopt computer technology' (p. 288). Compeau and Higgins (1995a) indicate that a person's self-efficacy regarding computers significantly affects the user's expectations, and Compeau *et al.* (1999) also suggest that SE in using information technology is an important factor influencing an individual's ability to infuse technology into his/her practice. Hill *et al.* (1987) found that college students' computer self-efficacy affects their decision to use computers. Other researchers (Eden and Ravid, 1982; Gist, 1987; Gist and Mitchell, 1992) investigated the relationship between training effectiveness and self-efficacy.

Based on the previous studies as discussed above, this research intends to verify the relationship between computer self-efficacy and behavioral intention (BI) with hypotheses as follows:

H1: Self-efficacy affects perceived ease of use of mobile phones.

H8: Self-efficacy affects intention to adopt mobile phones.

3.2.2 HB2 and HB7: Ease of Use (EOU)

According to Davis (1989), the EOU construct is a significant determinant of perceived usefulness (PU), 'the degree to which a person believes that using a particular system would enhance her or his job performance (p. 320),' and he insisted that ease of use and perceived usefulness are salient beliefs that determine BI. TAM posits that the impact of other external variables on behavioral intention is fully mediated by these two beliefs (EOU and PU).

H2: Ease of use affects perceived usefulness of mobile phones.

H7: Ease of use affects the intention to adopt mobile phones.

3.2.3 H6: Perceived Usefulness (PU)

TAM and TAM2 (Davis *et al.*, 1989; Venkatesh and Davis, 2000) suggest that PU is a direct and indirect predictor of BI. From this general statement, the degree of intention to adopt mobile phones will be measured within the three initial constructs (SE, EOU and PU). Hence, the third hypothesis is:

H6: Perceived usefulness affects intention to adopt mobile phones.

3.2.4 H3 and H9: Subjective Norm (SN)

According to theory of reasoned action (TRA:

Fishbein and Ajzen, 1975; Ajzen, 1991), the rationale for a direct effect of subjective norm (SN) on BI is that people may choose to perform a behavior, even if they are not themselves favorably inclined to the behavior, or its consequences, if they believe that one or more of their important referents think they should, and they are sufficiently motivated to comply with the referents.

Mathieson (1991) suggests that social pressure does not influence individual decisions to use a spreadsheet. Taylor and Todd (1995) and Venkatesh and Davis (2000), however, found a significant effect of SN on BI, and Venkatesh and Davis (2000) insisted that SN affect PU as well. Lee (2003a) also suggested that Koreans' adoption of ICT has a social normative implication. These discussions lead to the following hypotheses:

H3: Subjective norm affects perceived usefulness of mobile phones.

H9: Subjective norm affects intention to adopt mobile phones.

3.2.5 H4 and H10: Word-of-Mouth (WOM)

Media can be divided into mass media and interpersonal media based on DIT (Rogers, 1995). Mass media potentially influence more the planning stage of ICT than interpersonal media, while interpersonal media can be used as a significant tool at the stage of adoption than mass media. In the e-global age, however, digitalization has created a customer-driven market. e-customers create their own communities, and their personal experiences are quickly communicated throughout the network. Thus, the impact of word-of-mouth becomes more important and powerful with networks. Cisek (1993) reported that over

66 percent of current users of a Mexican private, non-governmental family planning organization indicated that they visited the clinic based on the recommendation of a friend, neighbor, or relative.

According to Lee (2003a), word-of-mouth communication is a determinant of the world leading ICT adoption by Koreans because most are Internet users living in close proximity to one another, usually in huge apartment complexes. Through e-communities, WOM effect heavily influences perceived usefulness and also directly affects intention to adopt innovations.

H4: A positive word-of-mouth positively affects perceived usefulness of mobile phones.

H10: A positive word-of-mouth positively affects intention to adopt mobile phones.

3.2.6 H5 and H11: Advertising (AD)

According to Dube *et al.* (1996), a considerable amount of research on advertising has suggested that peoples' attitudes are based not solely on beliefs and attributes such as cognition, but also on feelings and emotions. According to Rogers (1995), mass media channels are relatively more important at the knowledge stage, while interpersonal channels are relatively more important at the persuasion stage in the innovation-decision process.

Wansink *et al.* (1998) suggested that advertising tends to have a favorable impact on attitudes toward a brand for three different reasons: (1) enhancing perceptions of the new brand, (2) enhancing perceptions of product versatility and (3) evoking favorable product attributes. To successfully substitute the target brand into a new market, the product must be perceived as possessing a different usefulness from existing products, and

advertising is most likely to change users' attitudes (Wansink *et al.*, 1998).

Rogers and Chen (2002) insisted that relative advantage through advertising, captures the extent to which a potential adopter views innovation (a brand, product, or service that perceived as new to decision maker) as offering an advantage over previous ways of performing the same task. Empirical studies (Adam *et al.*, 1992; Montoya-Weiss and Calantone, 1994) supported the importance of relative advantage in predicting adoption behavior. This leads to the following hypotheses:

H5: Effective advertising positively affects perceived usefulness of mobile phones.

H11: Effective advertising positively affects intention to adopt mobile phones.

IV. Results and Discussion

4.1 Data Collection

This research is based on a survey of mobile phone users in Korea. The survey was conducted in South Korea as it presents a unique opportunity to study mobile phone adoption for several reasons:

- (1) CDMA (Code Division Multiple Access) technology was implemented for mobile communications, and International Mobile Telecommunications (IMT)(2000 technology began commercial service for the first time in the world in 1996 (Lee, 2003a).
- (2) A hotbed (incubator) of new Internet-based products or solutions: Korea is experiencing a rapid growth of mobile commerce. Cur-

rently, Korea has the highest ratio of stocks traded online (about 70%) and high speed Internet (more than 60%) in the world (Turban and King, 2003; Lee, 2003a).

- (3) The high level of willingness to experiment with and minimal resistance to new technologies on the part of Koreans: Since Koreans have gained self-efficacy from the successes of e-transformation and the can-do spirit nurtured through overcoming countless hardships, Koreans have found confidence to adopt modern ICT (Lee, 2003a).

The questionnaire was originally designed in English and then translated into Korean. To avoid cultural bias and ensure validity, the Korean version was translated back into English in order to detect any significant misunderstanding due to translation. The questionnaire utilized a 5-point Likert-type scale for measuring variables. For the pilot study, the questionnaires were distributed to 40 undergraduate and 20 graduate students, most with full time jobs, in U.S.A. The pilot study of the English version was based on the 55 returned questionnaires from the 60 students. Based on this test, a pilot test of the Korean version was administrated to Korean international students at a University in USA. In survey design, this study used double blind translation between English and Korean to do comparative study in the near future.

On the basis of the pilot study results, the questionnaire was revised three times. The questionnaires were redistributed to mobile phone users and potential ones in eight Korean universities from March 15, 2003 and April 12, 2003, as college students are some of the primary current and future users of mobile phones. Data

were collected from 610 subjects. Complete and useable questionnaires were received from 594 respondents.

4.2 Operationalization of Measurement Variables

In this paper, **Perceived Usefulness (PU)** is defined as “the degree to which a person believes that using particular system would enhance his or her job performance (Davis, 1989, p.320).” That is, people tend to use or not use an application to the extent that they believe it will help them perform their job better. Davis also referred to **Perceived Ease of Use (EOU)** as “the degree to which a person believes that using a particular system would be free of effort (Davis, 1989, p. 320).” Davis claimed that all else being equal, an application perceived to be easier to use than another is more likely to be accepted by users.

Perceived Self-Efficacy (SE) means “judgments of how well one can execute courses of action required to deal with prospective situations (Bandura, 1982, p.122).” Bandura (1982) also referred to perceived self-efficacy as “people’s beliefs about their capabilities to exercise control over their own level of functioning and over events that affect their lives (1991, p. 257).” According to Ajzen (1985, 1991), Ajzen and Madden (1986), and Madden *et al.* (1992), self-efficacy is an individual’s self-confidence in his/her ability to perform a behavior. This concept comes from behavioral control (Taylor and Todd, 1995). Specifically, self efficacy is internal control which is related to knowledge (Venkatesh, 2000).

TAM2 incorporates additional theoretical constructs spanning social influence processes and

cognitive instrumental processes (Venkatesh and Davis 2000). Among the social influence processes, subjective norm is the principal construct of TPB (Ajzen, 1985). As another extension of TRA, TPB asserts that behavioral intention is formed by one's attitude, perceived behavioral control, and subjective norm, which reflect perceptions that significant referents desire the individual to perform or not perform a certain behavior (Taylor and Todd, 1995). Consistent with TRA, Venkatesh and Davis (2000) tap into social influences via subjective norm. Social influence means the extent to which a member of a social network influences another's behavior (Rice and Shook, 1990).

From a media richness perspective, social influence is exerted through messages and signals that help form perceptions of the value of a product or an activity (Salancik and Pfeffer, 1978; Fulk *et al.*, 1987; Fulk and Boyd, 1991).

Subjective norm (SN) is defined as "the perceived pressure to perform or not to perform the behavior (Ajzen, 1991, p. 188)." Subjective norm is closely related to the communication network aspects of DIT which lie at the heart of the diffusion process. There are two types of social influence: (1) normative influence, which occurs when individuals confirm to use the expectations of others and (2) informational influence, which occurs when individuals accept information as evidence of reality (Rogers, 1995). In this paper, it is assumed that normative influence is related to subjective norm, and informational influence means word-of-mouth and advertising.

A medium is a way or a means for delivery of information in social systems. Media are classified into mass media and interpersonal media. The Bass model (Mahajan *et al.*, 1990) proposed

that consumers are influenced by two sources: word-of-mouth through interpersonal networks and advertising through mass media.

Word-of-mouth (WOM) is defined as "in speech but not in writing" by the Cambridge International Dictionary of English. According to Silverman (2001), word-of-mouth is the most powerful force in the market place. According to prospect theory (Kahneman and Tversky, 1979), all of the alternatives that a person faces are reduced to a series of prospects that are evaluated independently on the basis of an S-shaped value function. Prospect theory postulates that people's judgments display (1) reference dependence (carriers of value are gains and losses from a reference point) and (2) loss aversion (the function is steeper in the negative than the positive domain), and diminishing sensitivity (marginal values of both gains display and losses decrease with their size). The loss aversion built into prospect theory suggests that losses loom larger than gains (Einhorn and Hogarth, 1981). Psychologically, a one-unit loss is weighted more than an equal amount of gain. That is, a negative word-of-mouth of product should carry more damage than a positive word-of-mouth of product in the market.

Advertising (AD) is defined as "making something known generally or in public, especially, in order to sell it" by the Cambridge International Dictionary of English. Over the past decade, a considerable amount of advertising research has suggested attitude as a determinant of purchase behavior. The concepts of word-of-mouth and advertising adapted from Nilakanta and Scamell (1990), Brancheau and Wetherbe (1990), and Rogers' (1995) research are measured on 5 point-scales.

<Table 1> Results of Factor Analysis in Initial Adoption Determinants

	Subjective factors	Efficiency	Ease of use	Usefulness	Advertising
SUBJEC2	.866	.107	5.156E-02	.101	4.199E-02
SUBJEC1	.844	.132	3.593E-02	.144	4.156E-02
WOM2	.701	7.558E-02	.207	.247	.238
WOM1	.691	.131	.201	.197	.180
EFFI2	9.452E-02	.832	.151	8.945E-02	5.368E-02
EFFI3	.195	.814	8.841E-02	1.948E-02	.153
EFFI1	.115	.650	.444	.212	9.408E-02
EASE2	.114	.167	.824	-9.650E-03	9.017E-02
EASE1	.189	9.985E-02	.733	.297	.129
EASE3	9.032E-02	.468	.673	-3.052E-02	6.591E-02
USEFUL2	.250	.160	-7.509E-03	.845	4.846E-02
USEFUL1	.245	.129	5.146E-02	.828	8.399E-02
USEFUL3	8.052E-02	-9.013E-02	.339	.524	.204
ADVER2	7.883E-02	3.579E-02	3.661E-02	1.892E-02	.850
ADVER3	7.958E-02	.119	7.805E-02	.107	.839
ADVER1	.238	.130	.192	.170	.521
Eigen value	5.323	1.924	1.454	1.214	1.042
% of explained	33.272	12.024	9.087	7.590	6.514
Cumulative % of explained	33.272	45.295	54.383	61.973	68.487

4.3 Validity Test

In this study, principal component factor analysis was conducted to verify the concept validity of the measurement instrument using the varimax rotation approach. Since a meaningful factor could be divided into several insignificant factors as the number of factors increases, the initial adoption intention determinant and continuance intention determinant variables were analyzed separately. The factor analysis results related to initial adoption intention factors are shown in <Table 1>.

Based on exploratory factor analysis (EFA) for verifying conceptual validity of subjective fac-

tors, self-efficacy, ease of use, usefulness, and advertising, the factor loading of each factor appeared higher than 0.5. In this analysis, subjective norm and word-of-mouth are grouped into a same factor. Thus, a confirmatory factor analysis (CFA) was performed to investigate construct validity.

According to Kline (1998), CFA is better method than exploratory factor analysis (EFA) when the researchers test the hypothesis that a relationship between the observed variables and their underlying latent constructs exist.

Regarding the constructs validity, <Table 3> shows the standardized factor loadings (Lambda) and t-values ($p < 0.05$) which used the covariance

<Table 2> Covariance Matrix of Initial Adoption Determinants

	usef1	usef2	usef3	ease1	ease2	ease3	effi1	effi2	effi3	subn1	subn2	wom1	wom2	adv1	adv2	adv3	int1	int2
usef1	.936																	
usef2	.684	1.015																
usef3	.294	.344	1.033															
ease1	.271	.265	.307	.726														
ease2	.152	.116	.175	.449	.936													
ease3	.143	.118	.165	.385	.545	1.034												
effi1	.287	.266	.225	.371	.406	.550	.932											
effi2	.192	.210	.158	.287	.312	.481	.627	1.299										
effi3	.171	.207	.106	.220	.275	.450	.488	.675	1.036									
subn1	.295	.354	.191	.219	.159	.161	.212	.246	.244	.861								
subn2	.280	.326	.199	.221	.170	.162	.204	.221	.253	.699	.891							
wom1	.373	.305	.207	.274	.219	.255	.308	.231	.293	.394	.427	.887						
wom2	.351	.330	.264	.272	.207	.214	.289	.222	.236	.410	.427	.618	.803					
adv1	.270	.250	.189	.229	.234	.240	.261	.214	.220	.230	.214	.297	.335	1.041				
adv2	.166	.125	.215	.180	.172	.124	.180	.153	.175	.155	.160	.213	.234	.345	1.274			
adv3	.187	.199	.230	.210	.172	.193	.200	.165	.252	.159	.162	.221	.245	.369	.642	.989		
int1	.374	.296	.312	.336	.302	.321	.366	.258	.247	.250	.282	.362	.369	.372	.358	.293	.861	
int2	.351	.270	.262	.322	.323	.339	.375	.290	.269	.232	.291	.339	.347	.421	.411	.344	.721	1.034

<Table 3> Results of Confirmatory Factor Analysis for Initial Adoption Determinants

Constructs and Indicator	Lambda	t-value	Squard Multiple Correlation
Subjective norm			
SUBJEC1	1.00		0.79
SUBJEC2	1.03	20.96	0.81
Word-of-mouth			
WOM1	1.00		0.69
WOM2	1.01	20.39	0.78
Self-efficiency			
EFFI1	1.00		0.66
EFFI2	1.02	16.14	0.50
EFFI3	0.87	15.35	0.45
Ease of use			
EASE1	0.57	14.21	0.45
EASE2	0.70	13.93	0.52
EASE3	0.77	14.38	0.58
Usefulness			
USEFUL1	1.00		0.73
USEFUL2	0.99	16.67	0.66
USEFUL3	0.49	9.06	0.46
Advertising			
ADVER1	1.00		0.47
ADVER2	1.49	10.23	0.50
ADVER3	1.41	10.31	0.57

matrix as shown in <Table 2>. The analysis shows an overall significant loading for each item on its hypothesized construct (Lapierre *et al.*, 1999). Most of the squared multiple correlations are above .50, indicating a moderate level of reliability.

4.4 Goodness of Fit of Research Model

For the purpose of testing the hypotheses, a path analysis using structural equation modeling was performed. According to analysis results, using LISREL 8.52, the goodness of fit of the research model was assessed with the following results; $\chi^2 = 421.19$ ($p = 0.000$), degrees of freedom = 118, $\chi^2/df = 3.5694$, GFI = 0.93, AGFI = 0.89, NFI = 0.91, NNFI = 0.92, RMSEA = 0.066.

When the model is correct but its conditions may not be correct, the χ^2 value is likely to appear larger than it should. This result indicates a problem with χ^2 as an indicator of fit: the great-

er the sample size, the larger the χ^2 value. From this perspective, it is advisable to use the χ^2 value in conjunction with other fit indices (Jöreskog and Sörbom, 1989, 1993a-c). Medsker *et al.* (1994) suggested that χ^2/df ratios of less than 5 can be interpreted as indicating a good fit to the data with ratios less than 2 indicating over-fitting. The current model is reasonable in the χ^2/df ratio of 3.5694.

In this paper, the fit of the overall model is assumed appropriate on the grounds of high values of fit indexes including goodness of fit index (GFI). As shown in <Table 4>, the other values of goodness-of-fit are also acceptable. According to Kline (1998), GFI and Adjusted GFI (AGFI) indicate that higher values are better than lower ones. Gefen *et al.* (2000) also suggest that the AGFI should be greater than 0.80. This model's fit values are higher than the recommended ones.

The root mean square error of approximation (RMSEA) is used to provide guidance on the number of optimal sub-constructs to use. Browne

<Table 4> Results of Goodness of Fit Test

Research Model	Values	Recommended Values
χ^2	421.19 (.000)	Significant ($p < 0.001$), Insignificant ($p > 0.05$ or $p > 0.01$)
χ^2/df	3.5694 (118)	< 5 interpreted 2~5 Good < 2 overfitting (Medsker, <i>et al.</i> , 1994)
PGFI	0.64	0 to 1 higher values, more parsimonious (Mulaik, <i>et al.</i> , 1989)
GFI	0.93	> 0.90 (Jöreskog and Sörbom, 1989)
AGFI	0.89	> 0.80 (Gefen, <i>et al.</i> , 2000)
NFI	0.91	> 0.90 (Jöreskog and Sörbom, 1989)
NNFI	0.92	> 0.90 (Jöreskog and Sörbom, 1989)
PNFI	0.71	Higher is better (James, <i>et al.</i> , 1982)
RMSEA	0.066	< 0.08 good < 0.05 excellent (Browne and Cudeck, 1992)
ECVI	0.89	Smaller values, better fitting (Kelloway, 1998)

and Cudeck (1992) suggest that this index should be lower than 0.08 for a good fit and less than 0.05 for an excellent fit. James *et al.* (1982) suggested taking parsimony (degrees of freedom) into account and define a parsimony normed fit index (**PNFI**), and Mulaik *et al.* (1989) suggested a parsimony goodness-of-fit index (**PGFI**).

The expected value of the cross-validation index (**ECVI**) estimates the expected discrepancy over all other possible calibration samples. ECVI has a lower bound of zero but no upper bound. Smaller values indicate better-fitting models (Kelloway, 1998).

V. Discussion of Results

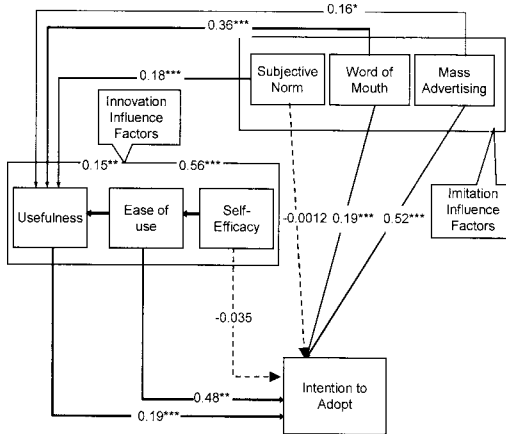
As shown in <Figure 10>, it appears that advertising is the most significant factor influencing the intention to adopt mobile phones. This result was unexpected because most research results have shown that usefulness is one of the most important factors in ICT adoption. A plausible explanation is that Korean mobile adopters have continuously changed their mobile phones due to a variety of reasons such as out of order, old-fashioned design, bad connection, bulky size, lost phone, and bad voice quality among others. Most respondents had extensive experience with the use of mobile phones at the time the survey was conducted, and the Korean mobile phone market has almost reached the saturation point (Lee, 2003b). Thus, respondents might have responded that advertising and ease of use were more important than usefulness. If this survey had been conducted earlier in the mobile phone life cycle, the results might have been different.

According to Lee (2003a), due to rapid ICT development and use over time, customers create

their own communities, and their personal experiences are quickly communicated throughout the network and create a critical mass. Thus, the impact of WOM becomes important and powerful in ICT adoption. Specifically in Korea, as most people are high-speed Internet users living in close proximity to one another, usually in huge apartment complexes, the word-of-mouth effect heavily influences customers who are networked. These empirical results support Lee (2003a) for ICT diffusion in Korea.

Unlike Hill *et al.* (1987), self-efficacy in innovation factors and subjective norm in imitation factors are shown to be statistically insignificant to the intention of adopting mobile phones; however, as Taylor and Todd (1995) and Venkatesh and Davis (1996) insisted, self-efficacy indirectly influences the intention to adopt mobile phones through mediating variables such as perceived ease of use. Another interesting finding is that imitation factors such as subjective norm, word of mouth and advertising enhance potential adopters' perceived usefulness of ICT.

In the favor of subjective norm, Venkatesh and Davis (2000) suggested that user acceptance research examining the direct effect of subjective norm on intention had yielded mixed results. Ajzen and his colleagues (1980, 1986, and 1991) considered the importance of subjective norm as a determinant of behavioral intention in TRA and the subsequent TPB. Taylor and Todd (1995) found a significant effect of subjective norm on intention, unlike Mathieson (1991) and Davis *et al.* (1989). In this study, subjective norm shows no direct effect on users' intention to adopt mobile phones; however, it indirectly affects the intention to adopt mobile phones channeled through usefulness.



주) ***: $p < .001$ **: $p < .05$ *: $p < .1$

〈Figure 10〉 Results of Hypotheses

VI. Conclusion

Until now, even though the technology acceptance model (TAM) has been criticized, TAM still dominates the adoption research area. This study attempted to overcome drawbacks of TAM by incorporating diffusion theory with imitation influence.

To examine the relationship between initial intention to adopt and determinant factors, 11 hypotheses were developed, and the path analysis using LISREL was performed. The results of the analysis showed that usefulness, ease of use, word-of-mouth and mass advertising are statistically significant on intention to initial adoption. In addition, subjective norm, word-of-mouth and mass advertising indirectly affect the intention of initial adoption through usefulness.

The results suggest a new mechanism of ICT adoption. Intention of initial adoption is affected by usefulness channeled through imitation factors such as subjective norm, word-of-mouth, and advertising. Until now, MIS researchers have by-

passed the importance of other areas such as marketing and sociology and there appears to be a real need to utilize an integrative approach for this research area.

Finally, the contributions of this research are as follows: First, this study shows imitation influence through critical mass and imitation effect in ICT adoption by using an empirical research. Until now, research results regarding imitation influence were mixed depending on the specific focus of research. However, this study clearly shows that the existence of an imitation influence in individual ICT adoption.

Second, the results suggest a new mechanism of ICT adoption. Intention to initial adoption is affected by usefulness channeled through imitation factors such as subjective norm, word-of-mouth, and advertising. Until now, MIS researchers have bypassed the importance of other research areas such as marketing and sociology. There appears to be a real need to utilize an integrative approach for this research area.

Third, this paper explores continuance adoption. To help ensure customer satisfaction, the manufacturers should always pay attention to customer needs, and this also sometimes leads to unexpected customer needs.

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An Empirical Study on Mobile Technology Adoption based on the Technology Acceptance Model and Theory of Planned Behavior

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Abstract

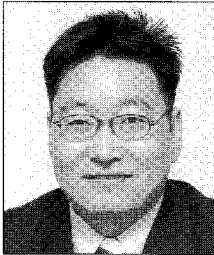
Previous studies indicate that information and communication technology (ICT) adoption is affected by innovation influence such as usefulness, ease of use and self-efficacy. Most of these studies, however, bypassed imitation influence such as subjective norms, word-of-mouth, and advertising, specifically, interactive innovation having critical mass in technology acceptance research. Thus, this study focuses to investigate imitation influence in individual adoption of mobile communication technology. The purpose of this study is to empirically examine the causal relationships between initial acceptance and the intention to use in terms of a holistic approach.

The results of this study show that there is an imitation influence including word-of-mouth and subjective norms, from the prior adopters to potential adopters, and mass advertising through TV or newspaper commercials in the ICT diffusion process. In addition, this imitation influence also stimulates innovation influence such as perceived usefulness. Finally, this study provides a set of guidelines to mobile communication equipment manufacturers and ICT vendors in developing effective strategies for technology diffusion.

Keywords: Technology Acceptance Model, Imitation Influence, Innovation Influence

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