

# The Factors Affecting Attitudes Toward HSDPA Service and Intention to Use: A Cross-Cultural Comparison between Asia and Europe

对影响HSDPA服务的态度和使用意图的因素的研究: 在亚洲和欧洲之间的一个跨文化比较

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## Abstract

HSDPA (High-Speed Downlink Packet Access) is a 3.5-generation asynchronous mobile communications service based on the third generation of W-CDMA. In Korea, it is mainly provided in through videophone service. Because of the diffusion of more powerful and diversified services, along with steep advances in mobile communications technology, consumers demand a wide range of choices. However, because of the variety of technologies, which tend to overflow the market regardless of consumer preferences, consumers feel increasingly confused. Therefore, we should not adopt strategies that focus only on developing new technology on the assumption that new technologies are next-generation projects. Instead, we should understand the process by which consumers accept new forms of technology and devise schemes to lower market entry barriers through strategies that enable developers to understand and provide what consumers really want.

In the Technology Acceptance Model (TAM), perceived usefulness and perceived ease of use are suggested as the most important factors affecting the attitudes of people adopting new technologies (Davis, 1989; Taylor and Todd, 1995; Venkatesh, 2000; Lee et al., 2004). Perceived usefulness is the degree to which a person believes that a particular technology will enhance his or her job performance. Perceived ease of use is the degree of subjective belief that using a particular technology will require little physical and mental effort (Davis,

1989; Morris and Dillon, 1997; Venkatesh, 2000).

Perceived pleasure and perceived usefulness have been shown to clearly affect attitudes toward accepting technology (Davis et al., 1992). For example, pleasure in online shopping has been shown to positively impact consumers' attitudes toward online sellers (Eighmey and McCord, 1998; Mathwick, 2002; Jarvenpaa and Todd, 1997).

The perceived risk of customers is a subjective risk, which is distinguished from an objective probabilistic risk. Perceived risk includes a psychological risk that consumers perceive when they choose brands, stores, and methods of purchase to obtain a particular item.

The ability of an enterprise to revolutionize products depends on the effective acquisition of knowledge about new products (Bierly and Chakrabarti, 1996; Rothwell and Dodgson, 1991). Knowledge acquisition is the ability of a company to perceive the value of novelty and technology of the outside (Cohen and Levinthal, 1990), to evaluate the outside technology that has newly appeared (Arora and Gambaradella, 1994), and to predict the future evolution of technology accurately (Cohen and Levinthal, 1990).

Consumer innovativeness is the degree to which an individual adopts innovation earlier than others in the social system (Lee, Ahn, and Ha, 2001; Gatignon and Robertson, 1985). That is, it shows how fast and how easily consumers adopt new ideas. Innovativeness is regarded as important because it has a significant effect on whether consumers adopt new products and on how fast they accept new products (Midgley and Dowling, 1978; Foxall, 1988; Hirschman, 1980).

We conducted cross-national comparative research using the TAM model, which empirically verified the relationship between the factors that affect attitudes - perceived usefulness, ease of use, perceived pleasure, perceived risk, innovativeness, and perceived level of knowledge management - and attitudes toward HSDPA service. We also verified the relationship between attitudes and usage intention for the purpose of developing more effective methods of management for HSDPA service providers.

For this research, 346 questionnaires were distributed among 350 students in the Republic of Korea. Because 26 of the returned questionnaires were inconsistent or had missing data, 320 questionnaires were used in the hypothesis tests. In UK, 192 of the total 200 questionnaires were retrieved, and two incomplete ones were discarded, bringing the total to 190

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questionnaires used for statistical analysis. The results of the overall model analysis are as follows: Republic of Korea  $\chi^2=333.27(p=0.0)$ , NFI=0.88, NNFI=0.88, CFI=0.91, IFI=0.91, RMR=0.054, GFI=0.90, AGFI=0.84, UK  $\chi^2=176.57(p=0.0)$ , NFI=0.88, NNFI=0.90, CFI=0.93, IFI=0.93, RMR=0.062, GFI=0.90, AGFI=0.84.

From the results of the hypothesis tests of Korean consumers about the relationship between factors that affect intention to use HSDPA services and attitudes, we can conclude that perceived usefulness, ease of use, pleasure, a high level of knowledge management, and innovativeness promote positive attitudes toward HSDPA mobile phones. However, ease of use and perceived pleasure did not have a direct effect on intention to use HSDPA service. This may have resulted from the fact that the use of video phones is not necessary for everyday life yet. Moreover, it has been shown that attitudes toward HSDPA video phones are directly correlated with usage intention, which means that perceived usefulness, ease of use, pleasure, a high level of knowledge management, and innovativeness. These relationships form the basis of the intention to buy, contributing to a situation in which consumers decide to choose carefully.

A summary of the results of the hypothesis tests of European consumers revealed that perceived usefulness, pleasure, risk, and the level of knowledge management are factors that affect the formation of attitudes, while ease of use and innovativeness do not have an effect on attitudes. In particular, with regard to the effect value, perceived usefulness has the largest effect on attitudes, followed by pleasure and knowledge management. On the contrary, perceived risk has a smaller effect on attitudes.

In the Asian model, ease of use and perceived pleasure were found not to have a direct effect on intention to use. However, because attitudes generally affect the intention to use, perceived usefulness, pleasure, risk, and knowledge management may be considered key factors in attitude development from which usage intention arises.

In conclusion, perceived usefulness, pleasure, and the level of knowledge management have an effect on attitude formation in both Asian and European consumers, and such attitudes shape these consumers' intention to use. Furthermore, the hypotheses that ease of use and perceived pleasure affect usage intention are rejected.

However, ease of use, perceived risk, and innovativeness showed different results. Perceived risk had no effect on attitude formation among Asians, while ease of use and innovativeness had no effect on attitudes among Europeans.

*Keywords:* HSDPA, Attitude toward service, Intention to use, Perceived risk, Innovativeness

## 摘要

HSDPA (高速下行分组接入) 是在第三代的W-CDMA技术基础上的3.5代移动通信异步服务。在韩国, 它主要是通过提供可视电话服务。由于更强大和多元化的服务扩散, 随着移动通

信技术迅速的进步, 消费者需要更多的选择。然而, 由于各种技术, 不论消费者偏好往往会溢出市场, 消费者感到越来越迷惑。因此, 我们不应该采取只注重发展假设是下一代新技术项目的战略相反, 我们应该了解消费者接受新的形式和技术的过程, 通过制定战略, 使开发人员能够理解并提供消费者真正想要的, 从而降低进入市场的障碍。

在技术接受模型(TAM)中, 感知到的有用性和使用的简单性被认为是影响人们接受新技术的态度的最重要因素(Davis, 1989; Taylor and Todd, 1995; Venkatesh, 2000; Lee et al., 2004)。感知到的有用性是一个人相信某种特定的技术能提高他或她工作绩效的程度。感知易用性是主观认为使用某种特定技术不需要太多体力和精力的付出的程度(Davis, 1989; Morris and Dillon, 1997; Venkatesh, 2000)。

感知的愉悦性和感知的有用性已经被清楚的证明对接受技术的态度有影响(Davis et al., 1992)。比如, 网上购物的愉悦性已经表现出对消费者对网上商家的态度有积极的影响(Eighmey and McCord, 1998; Mathwick, 2002; Jarvenpaa and Todd, 1997)。

消费者的感知风险是一种主观风险。这种风险和客观可能的风险是有显著区别的。感知风险包括心理上的风险, 这是当消费者为某一特定物品而选择品牌, 商店和购买方式时所感知到的。

企业革新产品的能力取决于有效的获得有关新产品的知识(Bierly and Chakrabarti, 1996; Rothwell and Dodgson, 1991)。知识获取是公司感知外界新事物和技术的价值的的能力(Cohen and Levinthal, 1990); 是公司评估外界最新的技术的能力(Arora and Gambaradella, 1994); 是公司正确预测这项科技对未来革新的能力(Cohen and Levinthal, 1990)。

消费者创新是一种在社会体系中比其他入更早接受创新的程度(Lee, Ahn, and Ha, 2001; Gatignon and Robertson, 1985)。也就是说, 它显示了消费者如何快速、方便地接受新的思路。创新被认为是重要的, 因为它对消费者是否接受新产品和他们多快接受新产品有显著的影响(Midgley and Dowling, 1978; Foxall, 1988; Hirschman, 1980)。

我们用技术接受模型来进行跨国家的研究比较, 此模型实证验证了影响态度的因素-感知有用性, 易用性, 感知愉悦, 感知风险, 创新和感知的知识管理水平-和对HSDPA服务的态度之间的关系。我们为HSDPA服务提供商开发更有效的管理方法还验证了态度和使用意图之间的关系。

在本研究中, 我们在韩国350名学生中分发了346份问卷调查。由于其中26份收回的问卷时不完整的或者有缺失数据, 所以在假设检验时320份问卷被使用。在英国, 200份问卷收回了192份, 舍弃了两份不完整的之后, 总共有190份问卷用于统计分析中。整体模型的分析结果如下: 韩国,  $\chi^2=333.27(p=0.0)$ , NFI=0.88, NNFI=0.88, CFI=0.91, IFI=0.91, RMR=0.054, GFI=0.90, AGFI=0.84; 英国,  $\chi^2=176.57(p=0.0)$ , NFI=0.88, NNFI=0.90, CFI=0.93, IFI=0.93, RMR=0.062, GFI=0.90, AGFI=0.84。

在韩国消费者中, 从有关影响HSDPA服务的使用意图和态度之间的关系的关系的假设检验的结果中, 感知的有用性, 易用性, 乐趣, 知识管理的高水平和促进创新对HSDPA移动手机的态度有积极的影响。然后, 易用性和感知的乐趣对HSDPA服务的使用意图没有直接的影响。这可能是因为在日常生活中使用视频电话还不是必需的这一现实。而且消费者对HSDPA视频电话的态度和使用意图有直接的关系, 这些态度包括感知的有用性, 易用性, 乐趣, 知识管理的高水平和创新。这些关系构成了购买意图的基础, 并造成消费者决定谨慎购买的情况。

对欧洲消费者的假设检验结果揭示了感知的有用性, 乐趣, 风险和知识管理水平是影响态度形成的因素, 而易用性和创新则对态度没有影响。特别是效果价值和感知有用性, 在快乐和知识管理之后对态度有最大的影响。相反, 认为感知风险对态度影响较小。

在亚洲模型中易用性和感知的乐趣没有发现对使用意图有直接影响。然而, 因为态度广泛的影响使用意图, 感知有用性, 乐趣, 风险和知识管理可被视为从使用意图中的态度发展的关键因素。

总之, 感知的有用性, 愉悦和知识管理水平在亚洲和欧洲消费者中对态度形成都有影响, 这些梯度形成了消费者的使用意图。而且, 易用性和感知的乐趣对使用意图的假设被拒绝。

然而, 易用性, 感知风险和创新的创新有不同的结果。在亚洲消费者中, 感知风险对态度形成没有影响, 而在欧洲消费者中, 易用性和创新对态度都没有影响。

关键词: HSDPA (高速下行分组接入), 对服务的态度, 使用意图, 感知风险, 创新

## I. Introduction

Advances in communications technology have been remarkable because of recent progress in electronic technology. These advances in communications technology have extended the field of the mobile telecommunications industry, leading to qualitative improvement and diversification in mobile telecommunications services. In particular, in Korea, High Speed Downlink Packet Access (HSDPA) service was deployed on a commercial scale since SK Telecom introduced HSDPA service in the first half of 2006, and it has grown rapidly. It is expected that the number of subscribers will reach 11 million by 2011.

HSDPA (High Speed Downlink Packet Access) is a 3.5-generation asynchronous mobile communications service evolved from the third generation of W-CDMA. HSDPA technology theoretically offers a maximum download speed of 14 Mbps, but it can actually transmit mobile data at a speed of 2-3 Mbps (Jang, 2005). In Korea, it is mainly provided in videophone service.

Several studies on technical problems in HSDPA, such as the mechanisms and communication standards, have been conducted (Dirani et al., 2007; Necker, 2006). However, studies on consumer behavior must precede the developmental stage of the technology in order to approach HSDPA through an integrated marketing perspective. Because of the diffusion of more powerful and diversified services along with steep advances in mobile communications technology, consumers must have a wide range of choices. However, consumers feel increasingly confused by the variety new technologies, created regardless of consumer wants, which tend to overwhelm them.

Therefore, we should not prefer strategies that focus only on developing new technology on the assumption that new technologies are next-generation projects, but rather we should understand the process by which consumers accept new technologies and should devise schemes to lower market entry bar-

riers through strategies that enable developers to understand and provide what consumers really want. Although DMB and WiBro will compete with HSDPA in the mobile communications market, research on key factors unique to HSDPA services that affect usage intention is necessary.

Consequently, this study will describe the process by which consumers accept HSDPA, laying emphasis on the Technology Acceptance Model (TAM), which explains how consumers accept new technology.

Many studies introducing the TAM have been carried out to describe why accepters adopt specific technology in the new media (Davis, 1989; Taylor and Todd, 1995; Venkatesh, 2000; Lee et al., 2004). Similarly to studies on changes in adopters' attitudes and usage intention caused by perceived usefulness, perceived ease of use, and perceived pleasure, this paper will discuss comprehensively perceived risk, perceived level of knowledge management, and the innovativeness of consumers as considerations in how consumers accept new technology. In addition, this study tries to provide research results that can be applied to the global market through a comparative study at the national level rather than a study limited to domestic markets, because mobile communications technologies adopt international standards.

Based on the results of this study, the foundation of theoretical research on enlarged TAMs related to HSDPA services can be established, and we can point out managerial implications that will improve attitudes toward HSDPA services in mobile data communications business as it enters a new phase of growth.

## II. Theoretical Background

### 2.1 Technology Acceptance Model (TAM)

To introduce and establish new media in a society, it is essential that members of the society accept and use the services. In particular, usage by both users and providers should be premised on interactive new media services, which cannot be utilized by users only. Hence, many more utilizations are necessary than in usual services in order to spread new media services that have interactive characteristics (Park, 2003). However, services like HSDPA tend to be slowly accepted according to accepters' evaluation and attitudes and undergo a process by which consumers choose better alternatives after comparing them with similar services, while existing media services are accepted and diffused by a majority of users.

Therefore, studying the process that consumers use to evaluate and accept new technology, which is different from the process of accepting existing media, has become important (Moon and Kim, 2001). For that reason, the TAM theory, a theory that explains why accepters sometimes adopt specific technology but at other times do not, must be positioned as a theoretical ground from which to describe the factors that in-

fluence the acceptance of new technology and accepters' behavior in using it (Lin and Lu, 2000; Chang and Cheung, 2001).

In the TAM, perceived usefulness and perceived ease of use are suggested as the most important factors affecting the attitudes of consumers in accepting new technologies (Davis, 1989; Taylor and Todd, 1995; Venkatesh, 2000; Lee et al., 2004). Perceived usefulness is the degree to which a person believes that a particular technology will enhance his or her job performance. Perceived usefulness is related to productivity and efficiency and can be defined as the degree of subjective belief that using a particular technology will enhance his or her job performance. Perceived ease of use is the degree to which a person believes that using a particular technology will require little effort, that is, the degree of subjective belief that using a particular technology will require little physical and mental effort (Davis, 1989; Morris and Dillon, 1997; Venkatesh, 2000). After all, adopters' attitudes and intention to use are affected by perceived usefulness and perceived ease of use, and these two factors have a significant effect on accepters' attitudes and intention to use (Davis, 1989; Adams, Nelson, and Todd, 1992; Agarwal and Prasad, 1999; Lerderer et al., 2000).

The TAM is a theory that can predict the diffusion of various technologies from information systems to the Internet and Internet shopping malls, and it has been applied to various areas. In other words, the TAM is a model that can be easily applied to any field and is utilized as a tool that offers a powerful explanation by introducing diverse variables (Phillips, Roger, and Lee, 1994; Venkatesh and Davis, 2000). TAM can be an adequate theoretical background of this study, which will survey users' attitudes and usage intentions toward HSDPA videophones, as determined by the results of research on new technology using the TAM. However, we will look at the following in order comprehensively to examine many other factors that form attitudes toward HSDPA videophone service, except for the factors suggested in TAM model.

## 2.2 Perceived Pleasure

It was shown that perceived pleasure along with perceived usefulness has a decisive effect on attitudes toward the acceptance of technology (Davis et al., 1992). Pleasure in online shopping has a positive impact on consumers' attitudes toward online sellers (Eighmey and McCord, 1998; Mathwick, 2002; Jarvenpaa and Todd, 1997). Childers et al. (2001) claimed that online shopping could be differentiated by making online shopping environments more or less interesting through the use of interactive characteristics such as images, colors, humors, and animation, among others.

The research of Koufaris (2001) shows that pleasure affects the intention to revisit an establishment, and the study of Moon and Kim (2001) reveals that perceived pleasure exerts considerable influence on attitudes toward the World Wide Web and behavioral intention.

As determined by these research studies, perceived pleasure

is a factor that is necessary to the decision to adopt new technology; hence, it has a considerable effect on this decision. In this article, we will verify the relationship between perceived pleasure and attitudes toward HSDPA service.

## 2.3 Perceived Risk

The perceived risk of customers is a subjective risk, which can be distinguished from an objective probabilistic risk. Perceived risk includes a psychological risk that consumers perceive when they choose brands, stores, and a method of purchase to obtain a particular item.

The definition of perceived risk varies by researcher, but it can be roughly summarized into two points, that is, uncertainty about the result of a choice and an expectation arising from the result of a choice. From a more inclusive point of view, perceived risk can also be defined as uncertainty. Synthesizing these concepts, this study views perceived risk as the risk that consumers perceive in situations in which they must choose between alternatives, such as a choice of brands, stores, or method of purchase when they buy goods and services. We also define perceived risk as perceiving uncertainty and the importance of this uncertainty.

The research of Han (2007) shows that the level of perceived risk consumers have does not influence the willingness to depend on retailers. Ko (2008) shows that the perceived risk of purchasing a smart clothing has an influence on product attitudes and the intention to adopt.

In research in which they examined consumers' reactions to websites, Jarvenpaa and Todd (1997) argued that consumers perceived risks when they purchased from a website and that the risks could be classified into financial risks, social risks, performance risks, personal risks, and privacy risks. A personal risk is the possibility of suffering from damages occurred in shopping the wrong product. A typical example of personal risk is the loss of credit card information. A privacy risk arises when consumers input their personal information during web shopping and feel worried about the cumulative exposure of personal information.

## 2.4 Perceived Level of Knowledge Management

The ability of an enterprise to create innovative products depends on whether the enterprise can effectively acquire knowledge about new products (Bierly and Chakrabarti, 1996; Rothwell and Dodgson, 1991). In this context, knowledge acquisition means the ability of a company to perceive the value of novelty and technology of the outside (Cohen and Levinthal, 1990), to evaluate new forms of technology (Arora and Gambardella, 1994), and to predict the evolution of technology accurately (Cohen and Levinthal, 1990).

Researchers have conducted several studies on knowledge management, asserting that companies should apply the concept of knowledge management and should convert their thinking so

that knowledge management can help actual management. Choi and Lee (1999) proposed that knowledge management is composed of the knowledge creation stage, represented as knowledge creation, acquisition, development, discovery, construction, and so on; the knowledge sharing stage, represented as sharing, distribution, allocation, transition, and internalization, among other things; the knowledge storage stage represented as storage, systematization, coding, concretization, and possession, among other things; and the knowledge application stage, represented as utilization, application, employment, and linkage, among other things.

In a study of strategies for knowledge diffusion, Song et al. (1999) insist that human beings, CEO leadership, the conversion of organizations and cultures, the measurement function of knowledge performance, and the knowledge management system are factors that determine the success of knowledge management.

### 2.5 Innovativeness of Consumers

Consumer innovativeness is the degree to which an individual adopts innovation earlier than others in a social system (Lee, Ahn, and Ha, 2001; Gatignon and Robertson, 1985). That is to say, it shows how fast and how easily consumers adopt new ideas. Because innovativeness has a significant effect on whether consumers adopt new products and on how fast they accept new products, it is considered important in this field of study (Midgley and Dowling, 1978; Foxall, 1988; Hirschman, 1980).

Rogers (1983), a pioneer of the study of innovativeness, defined innovativeness as the degree to which an individual adopts innovation earlier than others in a social system. He classified consumers into innovators, early adopters, early majority, late majority, and laggards, according to their speed in adopting new products.

Similarly, Moore (1995) divided buyers into technological enthusiasts, visionaries, pragmatists, conservatives, and skeptics on the basis of a technology adoption lifecycle. Midgley and Dowling (1978) defined innovativeness as the degree to which an individual is receptive to new ideas and regarded it as an innate personality trait; hence, they believed that it had a significant effect on various forms of decision making and behaviors of consumers.

Previous studies of innovativeness (Hirschman, 1980; Midgley and Dowling, 1978; Rogers, 1983) considered innovativeness a characteristic related to personality that exists in all consumers and shows different degrees during their lifetime. They concluded that differences in innovativeness functioned as factors that may cause differences in the acceptance of new ideas or objects.

The research of Lee (2004) shows that innovativeness is a factor for customer satisfaction with the recommendation intention, and Oh (2009) reveals that personal innovativeness has a moderating effect on switching intention.

In particular, the need for a study on the characteristics of

innovative consumers has lately become apparent. In their study on the acceptance of new products in the electric home appliances market using panel data, Subin, Bayus, and Mason (2003) argued that demographic characteristics exerted a greater influence on the acceptance of new products than innate innovativeness did. On the contrary, in a study of the characteristics of innovative consumers that was carried out in Korea on consumers of wireless LAN, Hwang (2006) showed that more innovative consumers tended to be well-educated and engaged in a professional occupation with high income. Moreover, the rate of multi-possession of high-tech digital appliances or IT goods appeared higher in the group of more innovative consumers.

## III. Hypotheses and Research Design

### 3.1 Research Model and Hypotheses

New technology such as HSDPA, which was once considered impossible to develop, is no longer new because of the rapid growth of mobile communications technology. Many technology-oriented products have been developed and introduced into the market, only because they are innovative, but some of them have disappeared from the marketplace without having an opportunity to be used because developers failed to consider the market acceptability of technology or consumers' usage environment. Though some services survived in this setting by developing successful marketing strategies that considered global technology standards, even in those cases, consumers' usage environments or motivations to use a produce should be well understood, so that technology can be developed into a form that consumers want and are willing to accept.

Many researchers have begun to study consumers' attitudes toward new technology, because high-technology grows dramatically, which has created the need to assess the various factors that have been examined in existing studies. It may be also meaningful to study how innovativeness, the level of suppliers' knowledge management, and factors that affect attitudes in the TAM influence attitudes. Hence, research on a broad-

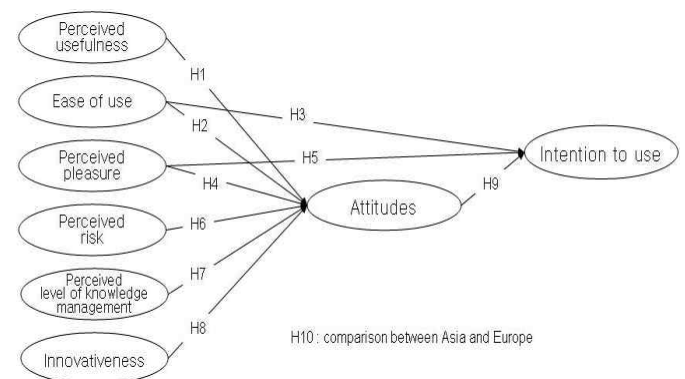


Fig. 1. Research model

ened TAM with a connection between theory and practice is required to understand the attitudes and usage intentions of HSDPA service adopters. We will conduct a comparative study between Asia and Europe in order to compare the differences in the state of technology and consumers' characteristics. Based on many previous studies, this paper presents a conceptual framework as illustrated in <Figure 1>.

Perceived usefulness in the TAM is the degree to which a person believes that a particular technology will enhance his or her job performance (Davis, 1999). To investigate the relationship between attitudes toward HSDPA service and perceived usefulness, we should discuss the findings of the study by Chen, Gillenson, and Sherrell (2002), which are similar to ours and showed that perceived usefulness meaningfully affected online retailers and had a positive effect on consumers' willingness to use online retailers. They also verified consumers' behaviors toward imaginary stores of a nonprofit organization and confirmed that perceived usefulness in the TAM was a significant determinant of attitudes toward the use of imaginary stores and a predictor of the behavioral intention to use the website of an organization. study Vijayasarathy (2004) showed that perceived usefulness had a positive effect on both attitudes toward online retailers and the intention to use an online shopping mall. Therefore, this study formulated the following hypothesis to verify the relationship between perceived usefulness and attitudes.

H1: Perceived usefulness will have a positive effect on attitudes.

The perceived ease of use in a TAM is the degree to which a person believes that using a particular technology will require little effort (Davis, 1989). Perceived ease of use becomes an important determinant of the decision to use a form of technology or a system for which perceived usefulness is a factor (Davis, 1989, 1993; Davis et al., 1992).

The result of testing the TAM in an IT area shows that perceived ease of use has a direct effect on the intention to use IT (Ann, Kim, and Lee, 2005). Karahanna and Straub (1999) found that perceived ease of use meaningfully influenced the intention to use a Windows system, and Gefen and Straub (2000) verified that the effect of the perceived ease of use in accepting IT and perceived ease of use were directly related to the intention to use. Hence, on the basis of preceding research studies, this study formed the following hypotheses to define the relationships between perceived ease of use and attitudes and between perceived ease of use and behavioral intention.

H2: Perceived ease of use will have a positive effect on attitudes.

H3: Perceived ease of use will have a positive effect on intention to use.

Davis et al. (1992) found that perceived pleasure along with perceived usefulness was an important determinant of attitudes toward technology acceptance. It was also found that perceived pleasure in online shopping had a positive impact on consumers' attitudes toward online sellers (Eighmey and McCord,

1998). Childers et al. (2001) revealed that perceived pleasure along with perceived usefulness and ease of use in the TAM functioned as a useful variable in measuring attitudes toward online shopping and had a powerful effect on attitudes toward online shopping. It was shown that in pleasant shopping conditions, perceived pleasure had a greater effect on attitudes than perceived usefulness did, while perceived usefulness was more important in an environment of practical shopping. To further discriminate these two kinds of shopping, researchers can add amusing elements such as images, colors, humors, and animation to the online shopping. This study formed the following hypothesis in order to define the relationships between perceived pleasure and attitudes and between perceived pleasure and intention to use.

H4: Perceived pleasure will have a positive effect on attitudes.

H5: Perceived pleasure will have a positive effect on intention to use.

Perceived risk increases a consumer's propensity to search or a tendency to search for information (Batra and Sinha, 2000; Campbell and Goodstein, 2001). It is because consumers search for information to confirm whether uncertain results caused by their acceptance of new products are acceptable or not (Dholakia, 2001; Dowling and Staelin, 1994). Hirunyawipada and Paswan (2006) found that the innovativeness and perceived risk of consumers had a significant effect on adopting new technology. They classified risk into financial risk, social risk, temporal risk, physical risk, performance risk, and psychological risk and claimed that such risks did not always hinder innovative consumers from accepting new products and that innovative consumers would search for information to reduce such risks so that they could feel confident in accepting the product. Hence, this study formulated the following hypothesis in order to define the relationship between perceived risk and attitudes on the basis of the preceding researches.

H6: Perceived risk will have a negative effect on attitudes.

A firm's ability to develop new products depends on the effective acquisition of knowledge about new products (Bierly and Chakrabarti, 1996; Rothwell and Dodgson, 1991). This capacity for knowledge acquisition means the ability of an enterprise to perceive the value of novelty and technology of the outside (Cohen and Levinthal, 1990), to evaluate technology from other markets that have newly appeared (Arora and Gambaradella, 1994), and to predict the evolution of technology accurately (Cohen and Levinthal, 1990).

Shu, Wong, and Lee (2005) found that a firm's ability to acquire knowledge had a controlling effect in a firm's connection to the innovativeness of products from other markets, which means that a firm's ability to manage knowledge can affect the innovativeness of new technology. Hence, this study formed the following hypothesis to verify the relationship between the level of a firm's knowledge management and the attitudes toward HSDPA service in mobile phones on the basis of the aforementioned research studies.

H7: Perceived level of knowledge management will have a

positive effect on attitudes.

Consumer innovativeness has been treated as a key factor in the study of the diffusion of innovation (Midgley and Dowling, 1978). Innovativeness is the tendency to accept transitions and to willingly try a novelty (Cotte and Wood, 2004); it is a tendency to buy new products more frequently and more quickly than other people (Roehrich, 2004). Hirunyawipada and Paswan (2006) found that consumer innovativeness and perceived risk influenced significantly the adoption of new technology. They also divided consumer innovativeness into three stages, namely, global innovation, specific range innovation, and innovative attitudes. They revealed that this innovativeness had a positive relationship with the acquisition of new information on new products and the actual acceptance of new products. On the other hand, Lasser et al. (2005) claimed in their paper that innovativeness had a negative relationship with the acceptance of new products, which suggests that innovativeness does not always exert a positive effect on adopting new products and provides a reason for why excessive innovativeness can have a negative effect on consumers' attitudes in an online environment. Hence, this study formulated the following hypothesis in order to determine whether innovativeness exerts an effect on attitudes toward HSDPA service on the basis of the aforementioned research studies.

H8: Innovativeness will have a negative effect on attitudes.

Researchers who tested the applied TAM, including the relationship between attitudes and behavioral intention in online shopping, verified that attitudes positively influenced behavioral intention (Chen and Tan, 2004; Heijden and Verhagen, 2004). Davis (1993) found that attitudes toward using technology had a significant effect on the intention to use. Favorable attitudes resulted in technology use, while unfavorable attitudes resulted in the rejection of technology use (Liker and Sindi, 1997). On this basis, this study formed the following hypothesis to verify the relationship between attitudes and behavioral intention.

H9: Attitudes will have a positive effect on intention to use.

As the number of large multinational corporations increases, marketers have struggled to develop new markets or expand into the global market by means of forming strong brand images or recognition of foreign consumers and buyers (Best Global Brands, 2006). Hence, this study formulated the following hypothesis to compare the Asian research model with the European one.

H10: There will be the same research model in Asia and Europe.

### 3.2 Operational Definition

Davis (1989) revealed in the TAM that adopters' attitudes and usage intention were changed by perceived usefulness and ease of use and functioned as antecedent factors that significantly affected attitudes and the intention to use. On the basis of Davis et al. (1992)' study, we classified perceived

usefulness into general usefulness, value, contents usefulness, and functionality and classified perceived ease of use into clarification and ease of use; we then measured each of them. Davis et al. (1992) demonstrated that perceived pleasure along with perceived usefulness acted as a variable that has a significant effect on the acceptance of new technology. Using the TAM, the research of Lee, Fiore, and Kim (2005) revealed that perceived pleasure influenced attitudes. We here measured perceived pleasure as interest, enjoyment, amusement, excitement, and charm.

Perceived risk is a factor that affects alternative decision making, and it can be defined as an action that signifies the expectation of a loss caused by a purchase and an obstacle to the act of purchasing a product (Peter and Ryan, 1976). In this study, we considered risk the concept of loss and divided perceived risk into performance risk, financial risk, temporal risk, physical risk, social risk, and psychological risk on the basis of Hirunyawipada and Paswan' research (2006) and then measured each factor.

Consumer innovativeness is the degree to which an individual adopts innovation earlier than others in the social system (Lee, Ahn and Ha, 2001; Gatignon and Robertson, 1985). This study measured innovativeness by using the concepts of indirect experiences, use, and adoption on the basis of Hartman et al. (2004)' research.

In the case study of firms that conduct knowledge management, Earl (1994) suggested that the utilization of a knowledge system like IT, the construction of network with the outside, the maintenance and utilization of knowledge workers, and the shift to learning organizations were the key factors to successful knowledge management. In this study, we measured the level of knowledge management by investigating a firm's ability to search outside knowledge, its knowledge level, and its communication networks on the basis of the research of Shu, Wong and Lee (2005).

Attitudes are habits of thought that consumers develop as a result of limited knowledge and are the effective formation of a particular discovery rather than a careful comparison in a situation in which they must choose between alternatives (Bettman and Michel, 1979). On the basis of the work by Lafferty et al. (2005), we classified attitudes into good, favorable, and satisfied to assess attitudes toward HSDPA service.

According to the theory by Fishbein and Ajzen (1975), which regarded usage intention as a proper predictor of behavior and suggested a conceptual framework through which behaviors are determined by intention, it can be said that behaviors are influenced by intention, which is affected by attitudes and subjective norms. We classified usage intention into certain and possible intention to use in order to assess the intention to use HSDPA services based on the research of Lafferty et al. (2005).

Questionnaires for Asia and Europe were designed respectively for a cross-cultural comparison. The questionnaire used in Europe was written in English on the basis of a questionnaire used in Asia (Kim et al. 2008). All inquiries except those regarding respondents' general characteristics were measured on a 5-point Likert scale.

### IV. Analysis of Research Results

The Asian population in this study was limited to college students in Seoul, Republic of Korea who were receptive to new technology such as HSDPA service, and likewise the respondents in Europe were mostly college students in UK. A pre-survey was carried out two weeks prior to the main survey. After the questionnaire was revised and ensured to be valid and reliable, the main survey was conducted.

Three hundred forty-six questionnaires were received by the 350 students to whom they were distributed in the Republic of Korea. Because 26 of the returned questionnaires were inconsistent or were missing data, 320 questionnaires were used in the hypothesis tests. In UK, 192 of 200 questionnaires were received, and two were incomplete and therefore discarded, making for a total of 190 questionnaires for statistical analysis.

We conducted frequency analysis to understand respondents' general characteristics, and statistics were generated for each inquiry on the questionnaire from the basic data gathered from the questionnaires. We also conducted validity analysis and reliability analysis for hypothesis tests using the SPSS WIN (Ver. 14.0) statistics package. Structural equation model analysis was carried out with LISREL (8.3) to test the structural model, which is presented here by using covariance matrix.

#### 4.1 Characteristics of Respondents

Table 1 summarizes the respondents' characteristics, which are classified according to gender, age, occupation, average allowance per month, and average communication expenses per

Table 1. Demographic Characteristics of Respondents (Asia and Europe)

Classification		Asia		Europe	
		Frequency	Percentage	Frequency	Percentage
Gender	Male	162	50.6	64	33.7
	Female	156	48.8	124	66.3
Subtotal		318	100	188	100
Age	20's - 30's	318	100	183	100
Subtotal		318	100	183	100
Occupation	Student	318	100	184	100
Subtotal		318	100	183	100
Average Allowance per Month	Under 1 billion won	18	5.6	0	0.0
	1 billion - 2 billion won	6	1.9	5	14.3
	2 billion - 3 billion won	30	9.4	2	5.71
	3 billion - 4 billion won	124	38.8	2	5.71
	4 billion - 5 billion won	70	21.9	4	11.43
Over 5 billion won		72	22.5	22	62.85
Subtotal		320	100	35	100
Average Communication Expenses per Month	Under 50 thousand won	90	28.1	78	41.94
	50 thousand - 1 billion won	192	60.0	75	40.32
	1 billion - 2 billion won	32	10.0	19	10.22
	2 billion - 3 billion won	4	1.3	9	4.84
	3 billion - 4 billion won	0	0.0	4	2.15
over 4 billion won		2	0.6	1	0.54
Subtotal		320	100	186	100

month. The dispersion of demographic characteristics of Asian and European respondents seems to be proper for testing hypotheses, and the comparison between the two groups seems to be reasonable, especially because the characteristics of the Asian and European respondents appeared similar.

#### 4.2 Tests for Reliability and Validity

We analyzed Chronbach's Alpha and conducted confirmatory factor analysis to test the reliability and validity of each measurement item, as shown in Table 2. All coefficients of Chronbach's  $\alpha$  exceeded 0.6, which assures internal consistency. The results of confirmatory factor analysis of the measurement items indicate that the fitness index of the structural model is substantially correct.

Table 2. Test Results of Reliability and Validity

Dimension	Items	Asia			Chronbach's $\alpha$	Europe			Chronbach's $\alpha$
		Path coefficient	t-value	Goodness of fit		Path coefficient	t-value	Goodness of fit	
Perceived usefulness	1	.84	17.42	$\chi^2=5.64$ (p=0.0) GFI: 0.99 RMR: 0017	.816	.83	12.99	$\chi^2=4.11$ (p=0.0) GFI: 0.99 RMR: 0020	.858
	2	.85	17.89			.84	13.31		
	3	.78	15.89			.77	11.82		
	4	.62	11.60			.62	8.91		
Ease of use	1	.59	10.70	$\chi^2=14.88$ (p=0.0) GFI: 0.98 RMR: 0042	.743	.57	8.10	$\chi^2=11.47$ (p=0.0) GFI: 0.97 RMR: 0051	.814
	2	.61	11.15			.58	8.15		
	3	.94	18.59			.97	14.39		
	4	.65	12.05			.59	8.33		
Perceived pleasure	1	.95	22.88	$\chi^2=88.41$ (p=0.0) GFI: 0.90 RMR: 0029	.930	.95	17.64	$\chi^2=57.57$ (p=0.0) GFI: 0.89 RMR: 0027	.891
	2	.92	21.70			.94	17.22		
	3	.97	23.53			.97	18.10		
	4	.92	21.47			.93	16.99		
	5	.75	15.78			.77	12.43		
Perceived risk	1	.89	18.54	$\chi^2=11.75$ (p=0.0) GFI: 0.98 RMR: 0043	.761	.87	13.89	$\chi^2=5.22$ (p=0.0) GFI: 0.99 RMR: 0036	.773
	2	.92	19.63			.93	15.16		
	3	.54	10.06			.54	7.76		
	4	.49	8.99			.52	7.28		
Level of knowledge management	1	.72	14.12	$\chi^2=88.14$ (p=0.0) GFI: 0.90 RMR: 0036	.853	.74	11.23	$\chi^2=52.67$ (p=0.0) GFI: 0.90 RMR: 0036	.769
	2	.73	14.26			.75	11.52		
	3	.78	15.66			.75	11.43		
	4	.82	17.11			.82	13.07		
	5	.76	15.28			.75	11.53		
Innovativeness	1	.72	14.16	$\chi^2=113.00$ (p=0.0) GFI: 0.91 RMR: 0032	.828	.71	10.53	$\chi^2=80.17$ (p=0.0) GFI: 0.88 RMR: 0076	.857
	2	.59	11.05			.55	7.54		
	3	.66	12.55			.59	8.34		
	4	.77	15.57			.69	10.12		
	5	.84	17.72			.79	12.19		
	6	.53	9.68			.82	12.87		
Attitudes	1	.64	12.12	$\chi^2=81.44$ (p=0.0) GFI: 0.89 RMR: 0081	.839	.66	9.62	$\chi^2=38.64$ (p=0.0) GFI: 0.91 RMR: 0071	.835
	2	.69	13.36			.70	10.39		
	3	.87	18.15			.85	13.68		
	4	.84	17.36			.85	13.67		
Intention to use	1	.61	11.18	$\chi^2=44.45$ (p=0.0) GFI: 0.95 RMR: 0048	.811	.60	8.39	$\chi^2=27.11$ (p=0.0) GFI: 0.95 RMR: 0050	.648
	2	.76	14.87			.75	11.18		
	3	.81	16.29			.79	12.09		
	4	.75	14.64			.78	11.87		
	5	.66	12.28			.65	9.40		

#### 4.3 Test for the Asian Research Model

We carried out structural model analysis in order to test the



hypotheses suggested in this study. The fitness level of the structural model that explains the structural relationship of construction concepts in the research model was  $\chi^2=333.27(p=0.0)$ , NFI=0.88, NNFI=0.88, CFI=0.91, IFI=0.91, RMR=0.054, GFI=0.90, AGFI=0.84, which means that the fitness of the structural model is generally adequate. As the test results show, the hypotheses that perceived risk will influence attitudes and that ease of use and perceived pleasure will affect intention to use were rejected, and the remaining hypotheses were accepted, as Figure 2 shows.

First, judging from the results of the hypothesis tests of the relationship between the factors that affect the intention to use HSDPA service and attitudes, we can conclude that perceived usefulness, ease of use, pleasure, level of knowledge management, and innovativeness form positive attitudes toward HSDPA mobile phones. However, it was revealed that ease of use and perceived pleasure, factors that affect the intention to use HSDPA service, did not have a direct effect on the intention to use, perhaps because video phones are not necessary for everyday life yet. Mobile communications technology is now positioned as an essential element of daily life or business, but video phones are still regarded as a secondary service. For that reason, we suppose that ease of use and perceived pleasure in HSDPA service of video phones are not always connected to the decision to buy these products.

However, a direct correlation between attitudes and usage intention has been demonstrated, which means that perceived usefulness, ease of use, pleasure, the level of knowledge management, and innovativeness form attitudes toward HSDPA video phones on the basis of which the intention of buy is established. It may be considered a situation in which consumers carefully decide to purchase an item.

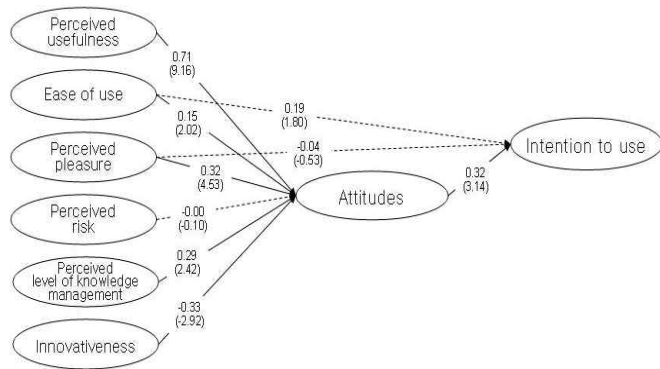


Fig. 2. Test for Research Model (Asia)

#### 4.4 Test for European Research Model

We carried out structural model analysis to test hypotheses suggested in this study. The fitness level of the structural model that explains the structural relationship of construction concepts in the research model was  $\chi^2=176.57(p=0.0)$ , NFI=0.88, NNFI=0.90, CFI=0.93, IFI=0.93, RMR=0.062, GFI=0.90, AGFI=0.84, which means that the fitness of the structural model was generally adequate. As the test results in-

dicate, the hypotheses that ease of use and innovativeness will influence attitudes and that ease of use and perceived pleasure will affect the intention to use were rejected in the test of research model for European consumers, as Figure 3 shows.

A summary of the results of the hypothesis tests for European consumers revealed that perceived usefulness, pleasure, risk, and level of knowledge management are factors that affect attitudes formation, while ease of use and innovativeness do not have an effect on attitudes. In particular, as the effect value shows, perceived usefulness has the largest effect on attitudes, followed by pleasure and knowledge management. In contrast, perceived risk has less effect on attitudes.

It was also found that ease of use and perceived pleasure do not have a direct effect on the intention to use, as in the Asian model. However, since formed attitudes generally affect the intention to use, perceived usefulness, pleasure, risk, and the capacity for knowledge management form attitudes from which the intention to use arises.

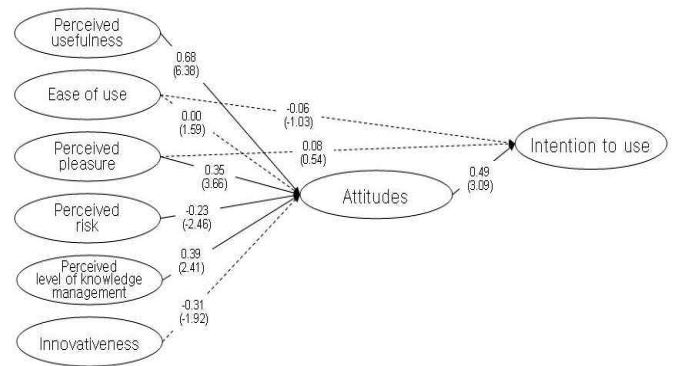


Fig. 3. Test for Research Model (Europe)

#### 4.5 Comparison of Research Results between Asia and Europe

The results of the hypothesis tests are summarized in Table 3, which shows the differences between Asia and Europe. The results show that perceived usefulness, pleasure, and the level of knowledge management have an effect on attitude formation in both groups and such attitudes shape the intention to use.

Table 3. Summarized Results of the Hypothesis Tests (Asia and Europe)

Hypothesis	Asia			Europe		
	Path coefficient	t-value	Result	Path coefficient	t-value	Result
Perceived usefulness → attitudes	0.71	9.16	accept	0.68	6.38	accept
Ease of use → attitudes	0.15	2.02	accept	0.099	1.59	reject
Perceived pleasure → attitudes	0.32	4.53	accept	0.35	3.66	accept
Perceived risk → attitudes	0.00	-0.10	reject	-0.23	-2.46	accept
Perceived level of knowledge management → attitudes	0.29	2.42	accept	0.39	2.41	accept
Innovativeness → attitudes	-0.38	-2.92	accept	-0.31	-1.92	reject
Ease of use → intention to use	-0.04	-0.53	reject	0.062	-1.03	reject
Perceived pleasure → intention to use	0.19	1.80	reject	0.085	0.54	reject
Attitudes → intention to use	0.32	3.14	accept	0.49	3.09	accept

Moreover, the hypotheses that ease of use and perceived pleasure affect usage intention are rejected in both cases. However, ease of use, perceived risk, and innovativeness showed different results, that is, perceived risk had no effect on attitude formation for Asian people, while ease of use and innovativeness had no effect on attitudes for European people.

## V. Conclusion

### 5.1 Research Results

Inexpensive mobile phones that one can buy as soon as he or she makes a deposit for a subscription at the mobile phone store have saturated the market ever since HSDPA video phones were offered for sale on a commercial scale. In particular, the diffusion of HSDPA video phones has increased as the government has eased restrictions on the conditions of grants for video phones. Of course, mobile communications users will shift to next-generation mobile communications technology over time, but such technology will succeed not merely when the new technology is considered brand new, but when it is also regarded as valuable and able to meet consumers' needs.

Taking HSDPA as an international standard into account, we must look at such phenomena from the viewpoint of the global market. Because the frameworks for this kind of technology service are all alike except for characteristics particular to each nation and because all companies engaged in HSDPA service industry focus on development of global marketing strategies, studies suitable to local situations are also necessary.

For that reason, we conducted a cross-national comparative research study that uses the TAM to empirically verify the relationship between the factors that affect consumers' attitudes and attitudes toward HSDPA service, as well as and the relationship between attitudes and usage intention for the purpose of developing more effective methods of managing HSDPA service providers. We devised a measurement model integrating several models and indicated the efficacy of other research methods. In addition, this study suggested practical managerial implications for marketing strategy of HSDPA service.

From the theoretical perspective, we tested a wide range of factors by introducing the concepts of perceived risk, innovativeness, and perceived level of knowledge management in order to overcome the limitations of previous studies on mobile communications technology using the TAM. The concrete implications deduced from this study are as follows.

First, we concluded that perceived usefulness, ease of use, and pleasure functioned as important factors affecting the intention to use new technology, such as HSDPA video phone service in Korea. Second-generation mobile communications, aided by the strong support of the government and favorable market environments, achieved substantial success, such that most adults own one or more mobile phones. In order for HSDPA video phones, which are examples of third-generation technology, to succeed, user-oriented ease of use, suitable addi-

tional services, and the development of programs that enable consumers to search for products voluntarily are necessary.

On the contrary, the relationship between perceived ease of use and the intention to use HSDPA service appeared to be meaningless in Europe, which indicated that Korean users react to new technology like HSDPA more quickly than European users. Consequently, marketers targeting Europe or somewhere similar should take these results into account when formulating a global marketing strategy.

However, the merits of HSDPA service cannot be directly connected to product purchases, because HSDPA service is now in the early stages of market development, and consumers need more time to verify that HSDPA is workable. Easy collection and feedback related to use of HSDPA service, including in Asia and Europe, are necessary right now.

Second, when the mobile communications market first formed, the only competition consisted of wired communication operators. However, in contrast, third-generation mobile communications devices have no choice but to face the reality of making existing subscribers use third-generation mobile communications. To make a bad situation worse, for this market to succeed, consumers will need to accept a certain level of risk. Although switching costs have decreased because of the deregulation instituted by the government, the financial risks and its resulting time costs, which arise from terminal changes, in some cases changing service providers or phone numbers, still present a risk. Similarly, judging from the results in Europe that perceived usefulness had no effect on attitudes, European users also recognize the adoption of HSDPA service as a risk. Therefore, tools that can offset the risks through providing differentiated services and content unique to HSDPA service are required.

Third, in the information society, knowledge management can determine how competitive a company is. Korean consumers constitute a fussy consuming-class that has some expert knowledge, as shown by the fact that the frequency transmission methods of each communications company have had an effect on decisionmaking in the past. Hence, upward standardization through continuous public relations and the establishment of an after-sales management system are necessary because consumers come to trust providers who can address their complaints immediately, and their confidence in providers is related to their attitudes toward products.

Fourth, early-adopters are comprised mostly of consumers who do the following: collect information about new products; buy, use, and rate the new products earlier than others whenever new products are launched; and then communicate characteristics of the products to other people. Hence, companies are now providing so called pro-sumers with new products and information about them before launching them, and, in return, early-adopters provide companies with an opportunity to improve the new products through their suggestions.

Fifth, the results of comparative research between the Asian and European models appeared similar except for the relationship between perceived usefulness and attitudes toward HSDPA service. The result that perceived usefulness had an influence on attitudes only in Korea may have been caused by cultural

traits, such as being more disposed toward accepting new technology quickly. Therefore, perceived usefulness is expected to have an influence on attitudes in Europe over time. From the global perspective, there are differences in the level of willingness to accept new technology among nations, and consumer characteristics vary by nationality. Therefore, marketing strategies should be developed that consider consumers' behavioral characteristics and that can be applied to all the nations generally.

## 5.2 Limitations and Future Research Issues

Although this study tried to clearly determine implications at the theoretical and practical

levels by surveying previous research studies and conducting an empirical study to elucidate the relationships between several factors and attitudes toward HSDPA, as well as the relationship between attitudes and usage intention, our study has the following limitations.

First, because the subjects of this study were limited to college students who are prone to using HSDPA services more frequently, the results are difficult to generalize. Moreover, even though HSDPA service is now provided throughout the entire country, the questionnaires were distributed only to students in living in metropolitan areas. Hence, the results do not reflect the opinions of consumers who live in other areas, limiting extrapolation of the findings.

Second, this study involved cross-sectional analysis. Although we tried to address this problem through a preliminary examination, it was not completely solved. In particular, because the results of perceived usefulness, ease of use, and pleasure in HSDPA service cannot be revealed in so short a time period, longitudinal analysis should be conducted in the future.

Third, we here introduced LISREL (8.3) to make a structural equation model. The biggest defect of LISREL is that only the models with complete model fitting are used in the analysis. Therefore, research methods that cannot show the process of model improvement are limited.

By complementing the limitations of this study, the new, more advanced research issues can arise. To that end, we suggest some considerations for future studies.

First, the independent variables of attitudes toward HSDPA service and usage intention and dependent variables should be distinguished more clearly. This study proposed perceived usefulness, ease of use, pleasure, risk, the level of knowledge management, and innovativeness as variables, but more factors should be considered in future studies.

Next, HSDPA service users should be fractionized in the analysis, and the factors affecting attitudes and usage intention should be presented in more detail, as acceptance of new technology, such as HSDPA, can vary according to demographic characteristics or the the adopters' lifestyles.

Finally, because perceived usefulness, ease of use, and pleasure may appear different according to the period of time in which they were observed, the changes caused by time factors should be interpreted through longitudinal analysis.

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