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### Recommended Citation

Kim, Hoyoung and Kim, Jinwoo, "Post-Adoption Behavior of Mobile Internet Users: A Model-Based Comparison between Continuers and Discontinuers" (2003). *SIGHCI 2003 Proceedings*. 4.  
<http://aisel.aisnet.org/sighci2003/4>

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# Post-Adoption Behavior of Mobile Internet Users: A Model-Based Comparison between Continuers and Discontinuers

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## ABSTRACT

Many mobile Internet users are not continuing to use mobile Internet services after initial use. This study aims to explore how such users (discontinuers) differ from ongoing users (continuers) in terms of accepting mobile Internet technology. We propose an adoption model for the mobile Internet consisting of seven critical factors. An on-line survey was conducted on the basis of this model to compare continuers and discontinuers. The survey results show that discontinuers are more sensitive to usefulness and social influences in using mobile Internet services, while continuers are more sensitive to ubiquitous connectivity.

## Keywords

Mobile Internet, Technology Adoption Model

## INTRODUCTION

“Mobile Internet” is defined as wireless access to the Internet through a mobile communication network (e.g., GSM or CDMA) by means of hand-held devices (e.g., mobile phones) (Federal Trade Commission, 2002). Many forecasters, basing their predictions on the uptake of standard mobile Internet phones, suggest that in the near future most Internet access will take place using small, wireless devices that, equipped with browser and wireless connection, provide “anywhere and anytime” access (Buyukkoken et al., 2000).

Despite this optimism, however, mobile Internet services face serious problems in terms of low profits and shallow customer bases (Businessweek, 2002). In order to increase the number of mobile Internet users, and hence profits, we need to understand how those who have stopped using mobile Internet service (discontinuers) are different from those who keep using it (continuers). It has been found that continuers behave differently from discontinuers in terms of accepting new technologies (Parthasarathy and Bhattrcherjee, 1998). Effective strategies for maintaining continuers will, therefore, be different from those for converting discontinuers into continuers (Bruner, 1998). In order to implement different strategies for discontinuers and continuers, we need to identify the differences in post-adoption behavior between the two groups.

Our objective in this study was to identify and compare the critical factors that affect the post-adoption behavior of continuers and discontinuers. In other words, which factors are effective in increasing the intention among discontinuers to use the mobile Internet, and how these factors differ from those that influence continuers?

## THEORETICAL BACKGROUND

Prior studies that specifically target the post-adoption behavior of mobile Internet users are scarce. For this reason, we based our mobile Internet adoption model on prior studies of technology-adoption in general in three areas: marketing (e.g., Zeithaml, 1998), technology innovation (e.g., Rogers, 1995), and information systems (Davis, 1989). Our research strategy was first to construct this model, and then to use it to compare the post-adoption behavior of continuers and discontinuers. In order to address our research questions, we have added three more aspects to the results of prior studies. First, among information technologies, mobile Internet services have certain unique characteristics, the most prominent being ubiquitous connectivity: users can use the services regardless of time or place (Dey, 2001). Second, the mobile Internet has been used mostly by individual consumers, rather than by corporate users or organizations (HCI Lab, 2002). Therefore, we have based our adoption model on consumer behavior studies (Dodds and Monroe, 1991). Third, this study investigates empirically the factors critical to post-adoption behavior, comparing continuers and discontinuers by means of structural equation models.

## THEORY AND RESEARCH HYPOTHESES

Our model for the adoption of mobile Internet services consists of seven important factors that affect post-adoption behavior (Figure 1).

### Continuers and Discontinuers

In general, critical factors that affect the adoption of products or services can differ according to user type (Venkatesh, 2000). In other words, people using a product or service consider different factors to be important, depending on what type of user they are.

Our study classified users of mobile Internet services into two groups: continuers, who keep using mobile Internet

services after their initial adoption, and discontinuers, who have adopted mobile Internet services and later ceased to use them. The two groups may be different in terms of the impact of post-adoption factors on perceived value and behavioral intention.

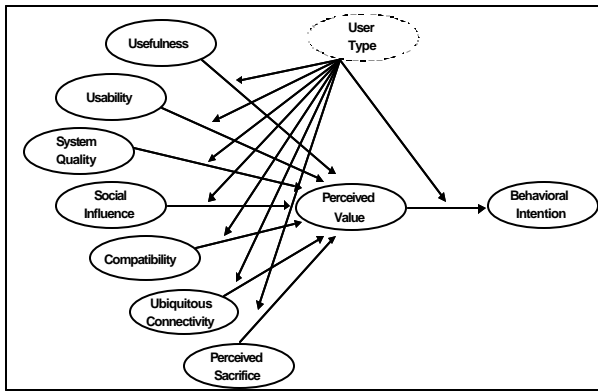


Figure 1. Adoption model for Mobile Internet service

### Usefulness

Usefulness, a subjective measure, can be defined as how much a user feels a new product is helping in his or her work (Rogers, 1995). When the usefulness of a new product is high, the product is adopted rapidly in the market. Parthasarathy and Bhattacharjee (1998) suggest that people are more willing to pay for useful on-line services than for less useful one. Karahanna et al. (1999) established that good quality and good function perceived by people allow them to adopt a new system easily in an organizational environment.

We hypothesize that continuers may be less sensitive to the usefulness of a technology, and that usefulness is thus more influential to discontinuers than to continuers. In other words, continuers, who usually are early adopters, keep finding value in the mobile Internet even though it is not as useful in their work as they expected (Rogers, 1995). In contrast, we hypothesize that discontinuers are more sensitive to usefulness, and that the perceived value of the mobile Internet drops significantly, for these users, if they find it is not as useful as they expected. Thus we propose as our first hypothesis:

*H1: Usefulness influences Perceived Value more heavily for discontinuers than for continuers.*

### Usability

The perceived value of mobile Internet services will depend in part on their usability. A system's usability is how easy it is to learn and use (Preece et al., 1994) and how comfortable it is to use (Davis 1989). Rogers (1995) suggests that a system is adopted quickly when a user can learn how to use the system easily. Nielsen (1993) proposes that for better usability a system must be efficient to use. Ajzen (1991) finds a high correlation between difficulty of use and choice of services.

We hypothesize that discontinuers are more sensitive to a technology's ease of use, and that usability will therefore have more influence on discontinuers than on continuers. In other words, discontinuers may be quick to stop using the mobile Internet when they experience difficulties. Karahanna (1999) also finds that non-users are affected more sensitively by usability. In contrast, early adopters and continuers keep finding value in the mobile Internet even though they experience difficulties in using it. It is common to see continuers proudly explaining how they overcome the initial difficulty of using a new technology. Thus we propose as our second hypothesis:

*H2: Usability influences Perceived Value more heavily for discontinuers than for continuers.*

### System Quality

System Quality refers to the perceived stability and efficiency of a system (DeLone and McLean, 1992). Speed and stability have been found to be just as important in determining the overall satisfaction of mobile Internet users (HCI Lab, 2002). Thus, the system quality of mobile Internet services may significantly affect both adoption and ongoing usage.

We hypothesize that discontinuers are more sensitive to the overall quality of a technology, and that system quality will be more influential on discontinuers than on continuers. In other words, early adopters and continuers keep finding the value of the mobile Internet even when the system quality is poorer than they expected. In contrast, discontinuers may be quick to stop using the mobile Internet when they experience system malfunctions. Thus we propose as our third hypothesis:

*H3: System Quality influences Perceived Value more heavily for discontinuers than for continuers.*

### Social Influence

Social Influence refers to the degree of interaction among people in their social context (Rice et al., 1990). Social influence helps determine whether technologies are adopted and whether products are purchased (Venkatesh, 1996).

Social influence may also affect the use of mobile Internet services. In fact, since mobile Internet services are a part of the telecommunications industry—an industry specifically designed to facilitate social interactions—social influence may be an even more important factor in service choice than it would otherwise be (Downes and Mui, 1998).

We hypothesize that social influence will be more powerful for discontinuers than for continuers. Continuers tend to keep using a new technology even when there are not many people with whom they can discuss the technology. In contrast, discontinuers have been found to depend more on the experiences of other users, communicated via interpersonal channels, in their assessment of the value of a new technology (Parthasarathy and Bhattacharjee, 1998). Thus we propose as our fourth hypothesis:

*H4: Social Influence affects Perceived Value more heavily for discontinuers than for continuers.*

### **Compatibility**

Compatibility refers to the conformity of an individual user's background with the services he or she is using (Rogers, 1995). Individual backgrounds might be formed by lifestyle and personal knowledge of frequently used products. Rogers (1995) suggests that a user adopts a new system quickly when the system is compatible with his or her everyday experience.

With their awkward input systems and small screens, mobile Internet services are quite different from traditional stationary Internet services, not only in terms of constrained resources but also in terms of the variety of use contexts (Bhagwat and Tripathi, 1994).

We hypothesize that compatibility will be more influential on discontinuers than on continuers. Continuers tend to keep using a new technology even when it is not quite compatible with their existing lifestyle. In contrast, discontinuers may be more conservative, in terms of requiring a new technology to fit into their existing lifestyle. Thus we propose as our fifth hypothesis:

*H5: Compatibility affects Perceived Value more heavily for discontinuers than for continuers.*

### **Ubiquitous Connectivity**

Ubiquitous Connectivity is the capacity of mobile Internet services to be used anywhere and at any time (Creativegood, 2000). When a user cannot access the stationary Internet for some reason, s/he can tap into Internet services through a mobile device like a cellular phone.

We hypothesize that ubiquitous connectivity will influence perceived value more strongly for continuers than for discontinuers. Continuers have been found to rely more heavily on external sources of information (Parthasarathy and Bhattacharjee, 1998), and ubiquitous connectivity is the most frequently mentioned characteristic of the mobile Internet (HCI Lab, 2002). Ubiquitous connectivity is one of the defining features of mobile Internet service, and continuers may be better acquainted with this feature, having used the services more than discontinuers. Thus we propose as our sixth hypothesis:

*H6: Ubiquitous Connectivity affects Perceived Value more heavily for continuers than for discontinuers.*

### **Perceived Sacrifice**

Perceived Sacrifice refers to both the physical costs and the mental effort that users say they encounter when using a given product or service (Zeithaml, 1988). Consumers' costs and efforts need to be considered when evaluating products or services (Zeithaml, 1988; Dodds and Monroe, 1991).

Compared with other information systems, the mobile Internet involves a higher perceived sacrifice. Mobile Internet services involve several types of monetary costs, such as an information usage fee, while most stationary Internet services are free (HCI Lab, 2002).

We hypothesize that discontinuers will be more sensitive than continuers to the perceived sacrifice involved in use of the mobile Internet. Specifically, discontinuers may consider the high cost of the mobile Internet more important than continuers do, significantly decreasing the overall value they find in the mobile Internet. Thus we propose as our seventh hypothesis:

*H7: Perceived Sacrifice affects Perceived Value more heavily for discontinuers than for continuers.*

### **Perceived Value and Behavioral Intention**

Perceived value, involving all the benefits users find in the purchase and use of a product or service (Zeithaml and Binter, 2000), affects Behavioral Intention, which is the degree of reported intention to use products or services in the future (Wakefield and Barnes, 1996). For example, Oh (1999) found that when a high value was attributed to a specific service, the behavioral intention to use that service in the future was greater.

We hypothesize that perceived value will affect behavioral intention more heavily for continuers than for discontinuers. Continuers may be more sensitive to the perceived value of the mobile Internet because they tended to be early adopters, who are usually more eager to use such services and more sensitive to a rise in perceived value. Thus we propose as our final hypothesis:

*H8: Perceived Value affects Behavioral Intention more heavily for continuers than for discontinuers.*

## **RESEARCH METHODOLOGY**

### **Development of Questionnaire**

To test the research constructs of our adoption model, we created a set of questions for a nationwide on-line survey of Korean mobile Internet users. Questions for all the constructs were adapted from related studies (e.g., Rogers 1995; Davis, 1989) in order to increase their content validity.

### **Data Collection**

After respondents had finished the online survey, their phone numbers and survey responses were sent to the telecommunication companies for data verification. The telecommunication companies checked whether the phone numbers reported were legitimately registered, and whether the owners of the phone numbers had used the mobile Internet at least once in the past. They also classified respondents as continuers or discontinuers. Those who had used the mobile Internet at least once, but had not used it at all in the past month, were categorized as discontinuers,

while those who had used the mobile Internet more than four times in the past month were classified as continuers. The criterion of more than four uses in a month is an industry standard widely used by telecommunication companies for customer management purposes (HCI Lab 2002). After verification and classification, the telecommunication companies returned the survey data to the authors, with phone numbers deleted to protect the privacy of survey respondents. In effect, we were able to increase the validity of survey data without significantly undermining the privacy of survey respondents. Finally, 1,789 respondents were classified as continuers and 1,770 as discontinuers. There is no statistically significant difference between the two groups, and the two groups were treated as two homogenous groups.

**Measurement Validation**

To ensure construct validity, explorative factor analysis was performed. Among the seven factors originally proposed, only six were extracted as independent variables; these were referred to as Usefulness, Usability, System Quality, Social Influence, Ubiquitous Connectivity, and Perceived Sacrifice. The two questions for the Compatibility construct were divided into Usefulness and Usability, respectively. Therefore, we dropped the compatibility construct in our further analysis and folded the two questions into the Usefulness and Usability constructs. Two factors were extracted as dependent variables: Perceived Value and Behavioral Intention. The variances explained were 59.4% for independent variables and 82.7% for dependent variables, and Eigenvalues of extracted factors were all above 1. Cronbach’s Alphas for all factors except Perceived Sacrifice exceeded the cutoff point of 0.7. The results of the CFA also indicate that all the questions were well converged into their respective constructs except the two compatibility questions. It was found that the square roots of Average Variance Extracted (AVE) were all larger than 0.5 except Perceived Sacrifice, and also larger than their corresponding correlation coefficients, which indicates that the metrics have appropriate discriminant validity (Gefen et al., 2000).

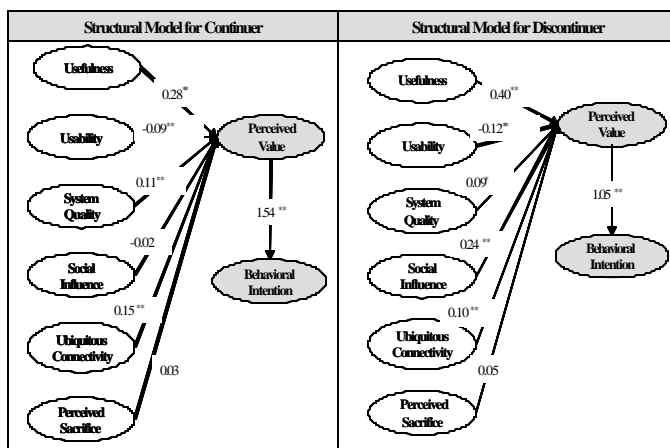


Figure 2. Comparison between continuers and discontinuers (\*<0.05, \*\*<0.01)

**RESULTS**

Structural equation modeling (SEM) analysis with LISREL version 8.13 was used to investigate the causal relations among these factors. Figure 2 presents two different causal models, one for continuers and one for discontinuers.

Multi-group analysis using LISREL was conducted for each causal relation in order to compare the strengths of influences for continuers and discontinuers. Chi-squares of the two models were calculated first, and then, after constraining the path coefficient of one variable, the Chi-squares of the two models were compared (Jaccard and Wan 1996). Table 1 summarizes the results of the multi-group analysis.

The impacts of Usefulness and Social Influence on Perceived Value were significantly greater for discontinuers than for continuers at the level of 0.001. Moreover, the impact of Perceived Value on Behavioral Intention was significantly greater for continuers than for discontinuers at the level of 0.001. Finally, the influence of Ubiquitous Connectivity on Perceived Value was greater for continuers than for discontinuers at the level of 0.01. In summary, hypotheses 1, 4, 6 and 8 were supported, whereas hypotheses 2, 3 and 7 were not supported, and finally hypothesis 5 could not be tested in this study.

Type	Chi-square	DF	Difference
Unconstraint	4327.94	556	-
Usefulness	4339.11	557	11.17 ***
Usability	4328.28	557	0.34
Sys. Qual.	4327.48	557	0.46
Social Inf.	4356.16	557	28.22 ***
Ubiquitous C.	4331.54	557	3.6**
Per. Sacrifice.	4327.72	557	0.22
Per. Value	4356.41	557	28.47***

Table 1. Sensitivity comparison between continuers and discontinuers (\*<0.05, \*\*<0.01, \*\*\*<0.001)

**DISCUSSION AND IMPLICATIONS**

This study attempts to identify important adoption factors that are different for continuers and discontinuers. The results of our online survey indicate that the two groups are different in terms of four adoption factors. First, in terms of the value they perceived in the mobile Internet, discontinuers were more sensitive than continuers to usefulness. Second, social influence was stronger on discontinuers than on continuers. Third, the impact of ubiquitous connectivity was stronger for continuers than for discontinuers. Finally, the impact of perceived value on behavioral intention was stronger for continuers than for discontinuers.

This study has several limitations. First, it suffers from a methodological limitation, in that it relies on an on-line survey. Second, the questions for Compatibility failed to be

converged into a single factor, and the Perceived Sacrifice construct could not meet the reliability and discriminant validity criteria. Third, the criterion that distinguishes continuers from discontinuers was set at more than four times in the month prior to the survey period. Fourth, we assumed that factors important in technology adoption generally will be also important to a comparison of continuers and discontinuers of mobile Internet services. Finally, the online survey was conducted in Korea, mostly with Korean mobile Internet users.

In spite of these limitations, the study has several interesting theoretical and practical implications. First, it views post-adoption behaviors from the perspective of the individual user. Second, the study suggests a model-based comparison method for analyzing post-adoption behavior. Third, this study provides empirical bases for marketing strategies targeted specifically at continuers/discontinuers.

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