

Chang, Younghoon; Kim, Min-Kyoung; Kim, Yaeun; Park, Myeong-Cheol

**Conference Paper**

## Determinants of user satisfaction and continuance intention of smartphones: Focus on interactivity perspective

8th Asia-Pacific Regional Conference of the International Telecommunications Society (ITS): "Convergence in the Digital Age", Taipei, Taiwan, 26th-28th June, 2011

**Provided in Cooperation with:**

International Telecommunications Society (ITS)

*Suggested Citation:* Chang, Younghoon; Kim, Min-Kyoung; Kim, Yaeun; Park, Myeong-Cheol (2011) : Determinants of user satisfaction and continuance intention of smartphones: Focus on interactivity perspective, 8th Asia-Pacific Regional Conference of the International Telecommunications Society (ITS): "Convergence in the Digital Age", Taipei, Taiwan, 26th-28th June, 2011, International Telecommunications Society (ITS), Calgary

This Version is available at:

<https://hdl.handle.net/10419/82140>

**Standard-Nutzungsbedingungen:**

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

**Terms of use:**

*Documents in EconStor may be saved and copied for your personal and scholarly purposes.*

*You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.*

*If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.*

# Determinants of User Satisfaction and Continuance Intention of Smartphones: Focus on Interactivity Perspective<sup>1</sup>

Younghoon Chang<sup>\*</sup>, Min-Kyoung Kim<sup>\*\*</sup>, Yaeun Kim<sup>\*\*\*</sup>, Myeong-Cheol Park<sup>\*\*\*\*</sup>

<sup>\*</sup>KAIST, KOREA, younghoonchang@kaist.ac.kr

<sup>\*\*</sup>KAIST, KOREA, byfaith@kaist.ac.kr

<sup>\*\*\*</sup>KAIST, KOREA, rosacalla@kaist.ac.kr

<sup>\*\*\*\*</sup>KAIST, KOREA, imcpark@kaist.ac.kr

The development and complexity of mobile and smart technologies continues to evolve with a greater speed, attention needs to be turned to the possibility of continuous development. It has become important to monitor users' post-purchase behavior in order to understand their continued use of smartphones and other smart devices. This study posits interactivity as a key variable to describe customer satisfaction and continuance intention in using smartphones. We classify interactivity into five sub-dimensions: system quality, network quality, contents quality, customer support, and compatibility. The established model in this study was empirically examined through survey research. Structural equation modeling demonstrated several key findings: contents quality is the most influential factor in shaping satisfaction, followed by compatibility, system quality, and customer support. The results also showed that satisfaction has a positive effect on the continuance intention. In addition, network quality had a positive direct effect on the continuance intention. Users also exhibit significant differences in post-purchase behavior, depending on their operating systems. These results will be helpful for the practitioners to further deliver appropriate service strategies for strengthening ongoing relationship with their customers.

**Key Words:** Interactivity, Satisfaction, Continuance Intention, Smartphone

---

<sup>1</sup> "This research was supported by the MKE(The Ministry of Knowledge Economy), Korea, under the ITRC(Information Technology Research Center) support program supervised by the NIPA(National IT Industry Promotion Agency)" (NIPA-2011-(C1090-1111-0013))

## **1. Introduction**

Juniper Research has announced their top ten predictions for 2011 in the mobile and wireless field, mostly driven by the consumer smartphone boom. Smartphone is one of the fastest-growing segments in telecommunications worldwide. Likewise, in Korea, the number of smartphone selling has exceeded 10 million as of March 2011. Nearly 20% of all the mobile telephone market can be made through smartphones. This figure is currently expected to reach more than 20 million by the end of 2011. Most of the mobile firms in Korea tend to heavily invest in the newest smartphones with fierce competition among the three mobile operators such as SK telecom, KT, and LG Uplus.

As smartphone market penetration increases each year, service quality has become a serious concern for service providers. It is common to find companies having problems regarding call quality of some budget smartphones and 3G network services from users. Furthermore, facing with the surging demand for cheaper price plans on both data and voice from consumers; impending regulation driven by KCC (Korea Communications Commission) will be a major concern for mobile operators. Korean operators thus face a nervous period of attempting to manage consumer complaints toward service quality of smartphones against cost. Consequently, it is important that customer satisfaction and continuance intention of smartphone users would be considered.

Smartphones enable all kinds of applications and services. Recently iPhone with Apple's app store - with more than 140,000 applications and 3 billion-plus downloads - is not only causing a quite stir to Korean operators but also redefining business models across the chain from production to consumption of the entire mobile industry. Smartphones have different ecosystems that emphasize openness as shared value network, not downward flow in case of existing feature phones. Wireless delivery of applications and great contents depends on the mobile platform. Although RIM by blackberry has set the standard for years, Android OS by Google is going through the roof. Within dynamic smartphone ecosystems which include smartphones manufacturers, portal or OS vendors, app developers, and network service providers, it shows a huge competition among groups of companies beyond wireless operators-oriented walled garden. Accordingly, this study attempts to understand the customer satisfaction and continuance intention of smartphone users in terms of their mobile

operating systems.

Smartphone is much closer to becoming the nearly ubiquitous environment that holds out an enormous potential for promising on-demand access to contents anytime and anywhere access to anything. It is expected that smartphone may allow for various interactions that would benefit both businesses and consumers as aspect of the interactive medium. The issue of interactivity apparently appears to play an important role to build customer relationship, and to offer practical insights for interactive advertising and marketing communications practice in computer-mediated environments [Yin and Staub, 2002; Wu, 1999]. Given research streams in interactivity researchers have begun to understand the concept of interactivity and to develop the multi-dimensional interactivity [Kiousis, 2002; McMillan and Hwang, 2002; Yang *et al.*, 2008], while little work has been done to explore relationship between multiple interactivities which affect continuance intention in using new interactive media such as smartphones.

The purpose of this paper is thus to examine precisely which factors may be essential in forming satisfaction and continuance intention based on the concept of interactivity with a user-centered perspective. The remainder of this paper is organized as follows. The next section provides the theoretical background of smartphones and its attributes, and interactivity. The next section develops related hypotheses and presents theoretical framework for this study, which is followed by the method and measures of the survey in this study. Then both the measurement model and the research model are empirically tested based on the evidence from Korea's smartphone users. Results and implications are discussed, and finally limitations and directions for future research are indicated.

## **2. Theoretical Background**

### **2.1 Smartphone characteristics**

An important factor distinguishing smartphones from existing feature phones (contemporary basic phone without advanced computing ability and internet connectivity) is that a smartphone allows the user to install and run more advanced applications with PDA-like (and even computer-like) features all through fast wireless web connection. The increase in smartphone market penetration is generating an initial demand for mobile applications ('apps') and app stores are very much a

smartphone phenomenon.

As mentioned earlier, smartphones are dramatically reshaping mobile industry competition. Wireless delivery of applications and great contents depends completely on what platform smartphone uses. Now the number of users may consider a smartphone not for the network it runs on or for what functions are built in but for what kinds of applications will run on it. Thus formerly separate mobile telecoms service industry architecture and their constituent firms are being forced into direct competition in the emerging mobile operating system race, looking at value capture and customer lock-in strategies.

Scholars and management consultants have identified platform control as a key feature for business success in the ICT industries. Recent studies have pointed out that a platform is the outcome of a set of business behaviors and relationships between actors in an ecosystem. And it is characterized as having high levels of interdependence between actors [Gawer and Cusumano, 2002; Gawer, 2009]. Wireless provider with clear market dominance before can still decide what operating systems and what phone models to sell, but platform leadership strategies have been degraded to service providers in the emerging ecosystem.

There are largely two groups in smartphones platform: open versus closed platform. The iPhone platform is closed, and the entire ecosystem is controlled by one company, Apple. On the other hand, Android offers developers the ability to build extremely rich and innovative applications by providing an open development platform. Namely, while Android appears to give more role of the number of participations motivated by market power while iPhone platform has interested in high-end market, showing high level of loyalty with Apple [Kim and Chang, 2011]. Accordingly, this study attempts to understand the smartphones ecosystem in Korea largely represented by two major platform, Android and iOS.

With the ongoing influx of new convergence technologies, many studies have highlighted to understand user adoption behaviors based on various theoretical discussions such as diffusion of innovation theory, users and gratification theory, and value-based adoption theory. Likewise, a number of studies have been performed mainly in the area of finding determinants for acceptance and adoption of innovative smartphones in Korea [Park and Chen, 2007; Kim, 2008; Bae and Jeong, 2008; Chen *et al.*, 2009; Jeong and Jang, 2010; Lee *et al.*, 2010]. In the aftermath of smartphones

diffusion, recent research work has emphasized on post adoption behavior. And they found that satisfaction positively affect continuance intention [Park and Shin, 2010; Oh and Bak, 2011]. As a consequence, this paper will empirically examine the positive relationships between a multidimensional view of interactivity and customer satisfaction/continuance intention from mobile operating systems perspective in the Korean smartphones market.

## **2.2 Interactivity**

There is lack of theoretical consensus regarding the scope and definition for “interactivity” across media. For example, interactivity has been employed as an assumed independent variable to describe the medium itself [Kayany *et al.*, 1996], as a dependent variable measuring people’s perception [Newhagen, 1995; Wu, 1999], and as a measure of media’s potential ability to let the user exert an influence on the contents and/or form of the mediated communication [Jensen, 1989]. Although these concepts would obviously suggest differing opinions, interactivity conceptions has commonly regarded as critical to successful marketing factor in an online environment [Lee, 2005].

What is interactivity in the context of smartphones? As McMillan and Hwang [2002] pointed out three different types of interactivity, smartphone users can interact with smartphone itself (Human-to-Computer) and also interact with other smartphone users and telecom service providers (Human-to-Human). And it also enables to enjoy/use contents with lots of applications (Human-to-Content) in the mobile web space. We thus assume that interactivity cannot be defined by a single dimension in this study. Based on this assumption, this study proposes a multi-dimensional interactivity from an integrated perspective and investigates the role of multi-dimensional interactivity in affecting satisfaction and continuance intention.

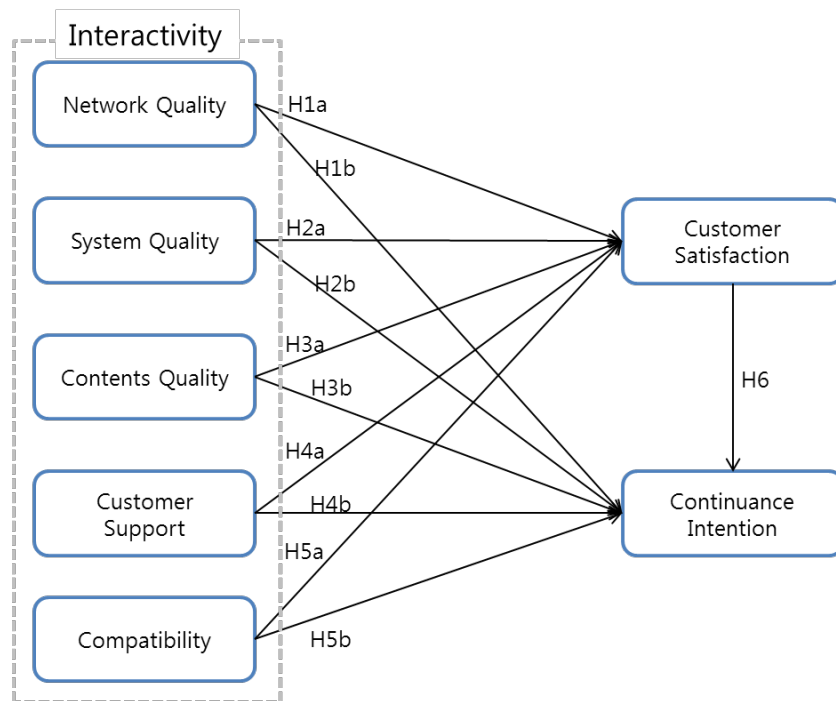
Many scholars have agreed that interactivity cannot be defined as a single dimension, or rather a complex mechanism that covers multiple processes, functions, and perceptions. Specifically, Heeter [1989] presented a six-dimensional interactivity: (1) complexity of choice available; (2) effort that users must exert; (3) responsiveness to the user; (4) monitoring of information use; (5) ease of adding information; and (6) facilitation of interpersonal communication. Kiousis [2002] and Lee *et al.* [2005] respectively outlined and investigated three interactivity dimensions: (1)

communication technologies, (2) communication contexts, and (3) people's perceptions. Besides, in other works four elements appear frequently in the interactivity literature: (1) direction of communications which encompasses the concepts of responsiveness (e.g., nature of feedback, response time), (2) user control (e.g., personalization, participation) and (3) timing flexibility which embraces timely speed (4) perceived purpose of communications [Downes and McMillan, 2000; McMillan and Hwang, 2002]. 10

The definition of interactivity offered here may be viewed as incorporating five dimensions found in much of the early literature primarily in smartphone communications context: *system quality*, which refers to the user perception on the characteristics of an interactive smartphones; *network quality*, which refers to the user perception on the ability of a network for real-time interaction; *contents quality*, which refers to the perceived utility of digital services added to a given smartphone medium; *customer support*, which refers to the perceived timely feedback interaction among user and mobile service provider; *compatibility*, which refers to the interactivity required to the personal task and business. Elements of the model and support for hypothesized relationships are elaborated in next section.

### **3. Conceptual Framework and Hypotheses**

Based on literature review, we propose the model as depicted in <Figure 1>. The primary goal of this study is to validate a model in which both customer satisfaction and continuance intention are examined with respect to interactivity. More specifically, we are interested to determine if interactivity (includes network quality, system quality, contents quality, customer support and compatibility) leads to customer satisfaction, and continuance intention in using smartphones. And this model also serves to examine the mediating impact of customer satisfaction on the continuance intention.



<Figure 1> Research model

### 3.1 Network Quality

Network quality has been one of the most important factors associated with the quality and satisfaction of mobile communications service [Kim *et al.*, 2004; Kim and Kim, 1999; Kim and Yoon, 2004]. Traditionally, an importance of the communication technologies usually anchored in its ability to facilitate real-time speed interactions have been highlighted [Shannon and Weaver, 1949; Kioussis, 2002]. Additional scholarly attention has suggested that timing flexibility and feedback as an attribute of the channel through which communication occurs should be considered as an important dimension of interactivity [Downes and McMillan, 2000]. As such, measuring the network quality construct within the smartphones context is applicable for our study. Network quality in this study refers to the perceived quality of each customer’s network based on the overall experience and the call quality of the chosen network. High speed data networks to offer the real time interactive experience might help predict attitude towards smartphones. Hypothesis 2 is thus proposed as follows:

*H1a: Network quality has positive effect on the customer satisfaction.*

*H1b: Network quality has a positive effect on the continuance intention*

### 3.2 System Quality



Smartphones having its own CPU, OS and various applications today can stand comparison with PCs. System quality in this study refers to customer perception of the physical abilities such as speed, high-definition resolution provided by smartphones itself. These system characteristics have been a variable of great concern to quite a bit of researches in the field of human-computer interaction. In the interactivity research stream, interactivity is determined by the technological structure of the medium [Steuer, 1992; Schneiderman and Plaisant, 2005]. For interactive media, Durlak [1987] expressed that interactivity become equated with the physical components of interactive system themselves. The literature has empirically found high correlation between the user's appreciation for the system and his utilization of its outputs in a query environment [Swanson, 1974] and in measuring information system success and failure [Power and Dickson, 1973]. Recent studies have generated considerable interest in system quality as a dependent variable of the customer satisfaction and user intention to use smartphones [Lee *et al.*, 2010; Jeong and Jang, 2010]. Therefore, we propose the following hypotheses:

*H2a: System quality has positive effect on the customer satisfaction.*

*H2b: System quality has a positive effect on the continuance intention.*

### **3.3 Contents Quality**

Contents quality in this study refers to the customers' demand and perception to value, reliability, and continuous update of contents [McKinney *et al.*, 2002] and applications presented on smartphones to operationalize interactivity. More advanced media technologies including smartphones enable to enhance multimedia contents will become new opportunities for telecom service providers and contents providers. Lee *et al.* [2006] empirically verified the effect of various mobile contents based on contextual offer by wireless connectivity. However, as the studies of smartphone mobile contents quality is still limited, this study attempts to modify a scale for measuring mobile value-added services appropriate for smartphones contents context. Among the studies of the telecom industry, value-added service positively influences customer satisfaction [Kim *et al.*, 2004; Kim and Kim, 1999]. Choi [2010] also emphasized on the contents including applications as a focal point of the smartphones competition. We thus hypothesized that perceived contents quality have a positive effect on the customer satisfaction and continuance intention:

*H3a: Contents quality has a positive effect on the customer satisfaction*

*H3b: Contents quality has a positive effect on the continuance intention*

### **3.4 Customer Support**

Customer support refers to the perceived interactivity of the regular customer support and technical support that service providers resolve incoming queries. Within the present framework, customer support could be seen as a dimension of interactivity dealing with facilitation of interpersonal communication from mobile carrier standpoint. Among the studies of the interactivity, interpersonal communication which includes actions engaged with the use of media has been employed for judging interactive experiences [Heeter, 1989]. In earlier studies on the Korean mobile telecommunication services, customer support from service quality perspective has been measured [Kim and Kim, 1999; Kim *et al.*, 2004; Kim and Yoon, 2004; Youn *et al.*, 2006]. In a similar vein, customers trust with their existing providers may positively influence satisfaction and maintain their subscription [Lee *et al.*, 2010]. For wireless service providers, supporting smartphones is increasingly complicated including the problem of device care, the variety of connectivity options, and service adds. Therefore, we propose the following hypotheses:

*H4a: Higher levels of customer support are associated with higher levels of customer satisfaction*

*H4b: Higher levels of customer support are associated with higher levels of continuance intention*

### **3.5 Compatibility**

Roger [1983] defines compatibility as “the degree to which the innovation fits with the existing values, past experiences, and current needs of potential adopters.” As a dimension of interactivity, characteristics of individual and interpersonal communication in psychology have been object of focus. Interactivity is a variable that fluctuate across individual [Newhagen, 1996; Kioussis, 2002]. Compatibility construct has been a key factor associated with the adoption of IT innovations, and it also has been used to measure user intentions to adopt smartphones [Park and Chen, 2007; Chen *et al.*, 2009]. In general, as compatibility increase, attitude towards information systems usage should become more positive [Taylor and Todd, 1995]. Dorothy [1993]

also highlighted that the compatibility of a system as its fit with the current equipment and task requirements in user's environment had a positive, significant influence on satisfaction. This leads to the following hypotheses:

*H5a: Compatibility has a significantly positive influence on customer satisfaction.*

*H5b: Compatibility has a significantly positive influence on the continuance intention.*

### **3.6 Satisfaction**

Customer satisfaction is typically defined as a post consumption reaction and judgment concerning a specific product or service. Oliver [1980] stated that it is the result of an evaluative process that contrasts pre-purchase expectation with perceived performance during and after the consumption experience. As many researchers have concluded [Jung and Lee, 1995; Oliver, 1997; Cronin *et al.*, 2000], customer satisfaction has long been recognized as a critical concept which positively increases customer loyalty, and influences continuance intention. Given the vital role of customer satisfaction, it is not surprising that a variety of research has been investigated the determinants of satisfaction in telecommunications service industry. Kim *et al.* [2004] concluded that customer support functions as an antecedent of customer satisfaction and customer loyalty in Korean mobile telecommunication service. Recently, Lee *et al.* [2010] verified the causal relationships between user satisfaction and actual use on smartphones. We thus formulate the following hypotheses:

*H6: Higher levels of customer satisfaction are associated with higher levels of continuance intention*

## **4. The Empirical Study**

### **4.1 Data Collection**

We chose the survey method to test the hypotheses and collecting sample from current users of Smartphone service. A pilot survey was conducted to revise and complement measure items of this study. The questionnaire was distributed to undergraduate and graduate students in KAIST campus by paper and online survey link. We collect the sample from March to April 2011 and a total of 229 respondents were participated for the survey.

The following <Table 1> summarizes sample characteristics in terms of gender,

age, operating system and service provider. Among the samples collected, the 20s age group was the majority. The characteristics of respondents were similar to mobile platforms profiles in Korea with top two popular Google Android and Apple iOS<sup>2</sup>.

<Table 1> Sample characteristics

Demographic Category (N=229)		Frequency	Percentage (%)
Gender	Male	172	75.1%
	Female	57	24.9%
Age	19-25	160	69.9%
	26-30	53	23.1%
	31-35	12	5.2%
	36-40	1	0.4%
	41-45	3	1.3%
Operating System	Apple iOS	106	46.3%
	Google Android	123	53.7%
Service Provider	SK Telecom	82	35.8%
	KT	134	58.5%
	LG U+	13	5.7%

## 4.2 Measurement

The instruments used to measure the constructs involved in this study are adopted from the comprehensive literature review, and developed to suit the context of smartphones. Specific items were scored on a 7-point Likert scales, ranging from ‘strongly disagree’ (1) to ‘strongly agree’ (7). The key questionnaire items are provided in Appendix A. Besides, we also ask questions about demographic characteristics, current usage pattern, and mobile platform.

## 5. Results and Discussion

### 5.1 Results of the Measurement Model

SPSS was used for descriptive statistical analysis and the partial least square (PLS) approach was used to estimate both the measurement and the structural parameters in the structural equation model. We used SmartPLS version 2.0 M3 for analysis. We examined the reliability, convergent validity and discriminant validity for the measurement instruments used in this study. Reliability was assessed using composite scale reliability (CR), average variance extracted (AVE), and Cronbach’s alpha.

<sup>2</sup> In terms of mobile operating systems, Android ownership (60%) is certainly dominating the smartphones market, followed by iPhone users (27%) in Korea. Source: [http://www.ddaily.co.kr/news/news\\_view.php?uid=75940](http://www.ddaily.co.kr/news/news_view.php?uid=75940)

<Table 2> exhibits adequate convergent validity for all constructs. Composite reliability ranged between 0.85 and 0.96 exceeding the 0.7, and AVE is greater than 0.5, an acceptable threshold for exploratory research [Nunnally, 1978]. Moreover, as indicated by Cronbach's alpha, it is higher than 0.7 the cut-off value [Hair *et al.*, 1998].

<Table 2> Construct Reliability Results

	Total			Apple iOS			Google Android		
	AVE	CR	C.α	AVE	CR	C.α	AVE	CR	C.α
Compatibility	0.74	0.90	0.82	0.69	0.87	0.77	0.79	0.92	0.87
Contents Quality	0.70	0.90	0.86	0.69	0.90	0.85	0.69	0.90	0.85
Customer Support	0.61	0.86	0.79	0.62	0.87	0.80	0.60	0.85	0.77
Network Quality	0.80	0.89	0.75	0.81	0.90	0.77	0.78	0.88	0.73
Continuance Intention	0.72	0.88	0.80	0.68	0.86	0.76	0.74	0.90	0.83
System Quality	0.68	0.87	0.77	0.69	0.87	0.78	0.66	0.85	0.74
Satisfaction	0.88	0.96	0.93	0.89	0.96	0.94	0.87	0.95	0.92

\* AVE: Average Variance Extracted, CR: Composite Reliability, C.α: Cronbach's alpha

As for discriminant validity, cross-factor loadings of the measures (see Appendix B) and a correlation matrix with the square root of AVE were used. <Table 3> showed that none of the intercorrelations of the constructs in this study exceeded the square root of AVE for the constructs. We confirm that each pair of constructs in this study was indeed distinct.

<Table 3> Discriminant validity

	Compatib ility	Contents Quality	Customer Support	Network Quality	Continua nce Intention	System Quality	Satisfacti on
Compatibility	<b>(0.862)</b>						
Contents Quality	0.538	<b>(0.837)</b>					
Customer Support	0.279	0.198	<b>(0.781)</b>				
Network Quality	0.180	0.323	0.183	<b>(0.893)</b>			
Continuance Intention	0.304	0.445	0.308	0.378	<b>(0.848)</b>		
System Quality	0.374	0.456	0.137	0.350	0.364	<b>(0.828)</b>	
Satisfaction	0.617	0.645	0.338	0.256	0.571	0.478	<b>(0.937)</b>

\* The diagonal elements in parenthesis are square roots of the AVEs and the remaining elements are interconstruct correlations.

## 5.2 Splitting the sample by mobile OS

As already mentioned, the most important software in smartphones is its operating system (OS), managing the hardware and software resources of smartphones. A mobile OS platform reflects user's lifestyle because it determines the choice of apps and smartphone functionality. According to Kim and Chang [2011], it is expected that mobile OS competition will be forced to the center of the future mobile telecoms market. As such, we assume that users can have different post acceptance behavior for each mobile platform. Thus, to better understand the differences in post adoption behavior relating to the mobile OS platform, we divided our sample into two groups: Android and iOS. The ANOVA test exhibited significant differences in two constructs: contents quality, system quality and continuance intention. We performed not only the full sample hypothesis test, but also the split sample hypothesis test.

<Table 4> ANOVA results for comparing iOS and Android users

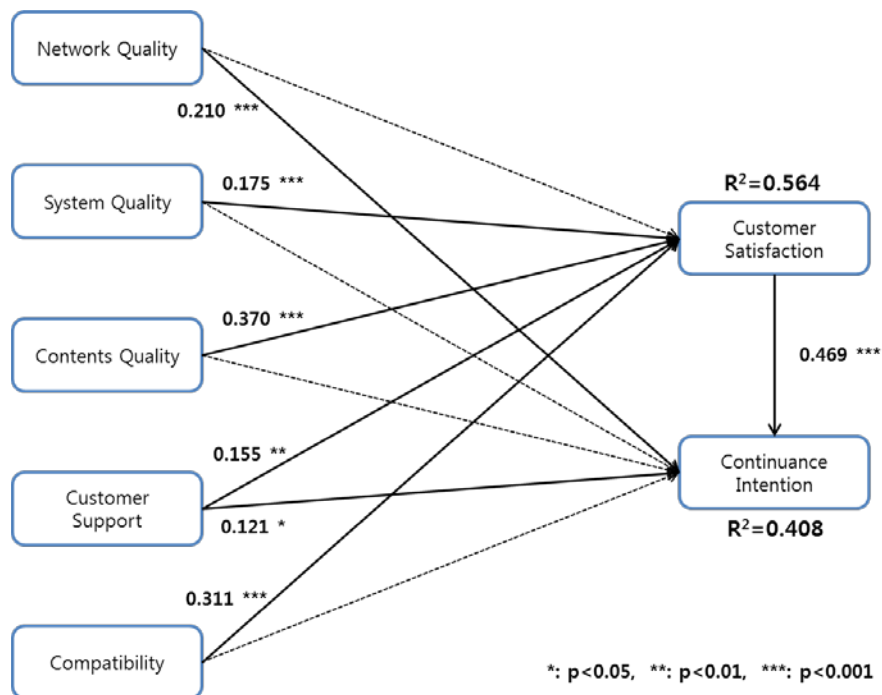
Construct	Apple iOS (N=106)	Android (n=123)	P-value
Compatibility	5.33	5.22	0.480
Contents Quality	5.38	4.95	0.001 *
Network Quality	4.48	4.62	0.393
System Quality	5.46	4.74	0.000 *
Customer Support	4.51	4.49	0.900
Satisfaction	5.76	5.50	0.097
Continuance Intention	5.14	4.72	0.020 *

\*:  $p < 0.05$

## 5.3 Results of the Structural Model

### 5.3.1 The full sample

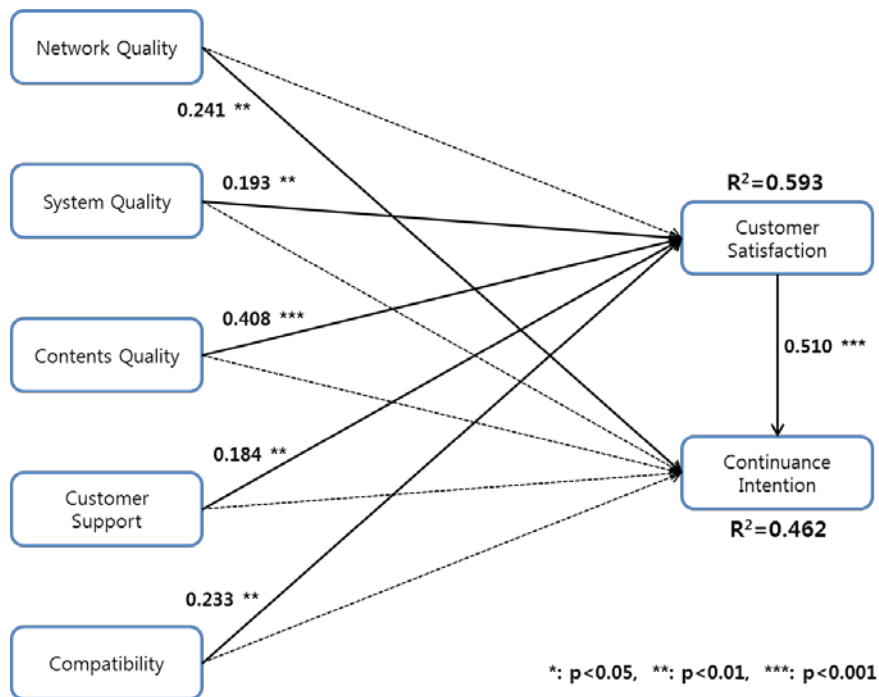
The results of path analysis for the full sample indicated that except for the direct effect of network quality on continuance intention and the direct effect of customer support on continuance intention, system quality, contents quality, customer support, and compatibility had significant influences on the satisfaction. Among the path coefficients towards satisfaction, contents quality played the leading role ( $\beta=0.370$ ), followed by compatibility ( $\beta=0.311$ ), system quality ( $\beta=0.175$ ), and customer support ( $\beta=0.155$ ) resulting in  $R^2$  for customer satisfaction of 56.4%. Finally, continuance intention is positively and significantly influenced by satisfaction ( $\beta=0.469$ ), network quality ( $\beta=0.210$ ), and customer support ( $\beta=0.121$ ) resulting in  $R^2$  for continuance intention of 40.8%. The results are shown in <Figure 2>.



<Figure 2> Path analysis: the full sample (N=229)

### 5.3.2 The split sample: Android users versus iOS users

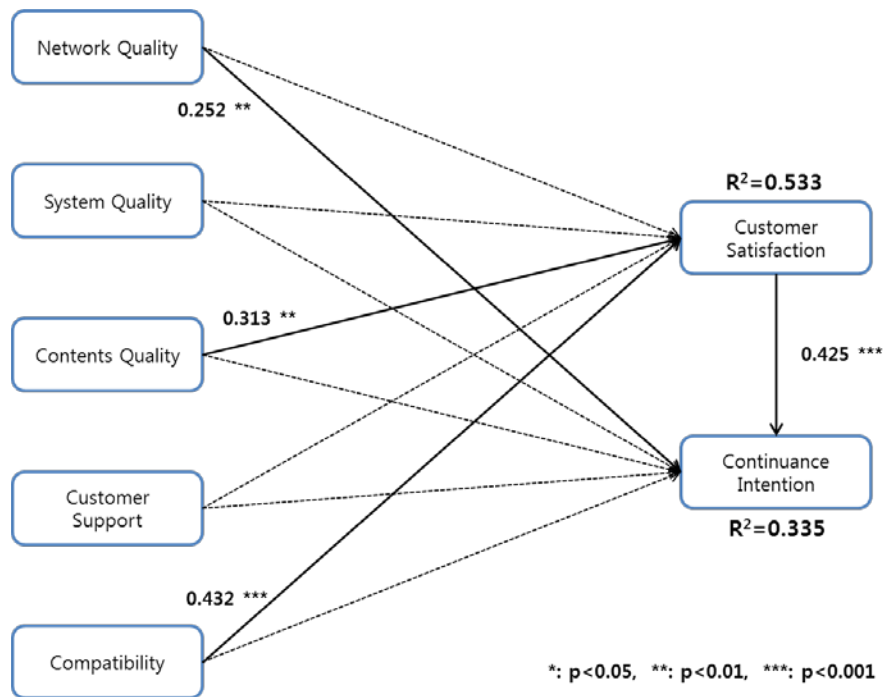
To better understand the difference in post adoption behavior between open platform (Android) and closed platform (iOS), this study also conducted a split sample path analysis. The full sample was divided into two groups based on the respondents' mobile operating platform in their own smartphone. For the Android users (Figure 3), the results showed a trend similar to the full sample. The research model explained 59.3% of the variance in the customer satisfaction. The determinants of satisfaction were mainly from contents quality ( $\beta=0.408$ ), compatibility ( $\beta=0.233$ ), system quality ( $\beta=0.193$ ), and customer support ( $\beta=0.184$ ). Furthermore, satisfaction was significant in shaping Android users' continuance intention. However, network quality was insignificant for satisfaction, in fact it directly affects continuance intention ( $\beta=0.241$ ).



<Figure 3> Path analysis for Android users (N=123)

On the other hand, the iOS users' results are illustrated in <Figure 4>. The satisfaction was significantly affected by compatibility ( $\beta=0.432$ ), and contents quality ( $\beta=0.313$ ) resulting in  $R^2$  for satisfaction of 53.3%. Therefore, Apple might be critical and consequently put emphasis on these factors. The reason why system quality and customer support were not significant is that Apple users might be more aware of technology in general and they might continuously recognize the system quality of iPhone is far superior. And the antecedents of continuance intention was from satisfaction ( $\beta=0.425$ ) and network quality ( $\beta=0.252$ ) resulting in  $R^2$  for continuance intention of 33.5%.





<Figure 4> Path analysis for iOS users (N=123)

## 6. Conclusions and Implications

The primary purpose of this study was to validate the effect of multi-dimensional interactivity on satisfaction and continuance intention in the Korean smartphone ecosystems. Specifically, this study proposed that influential interactivity factors differ depending on the mobile platform. In the following, we summarized the conclusions reached on hypotheses we have formed in this study. We also provided the theoretical and practical contributions.

First, mobile carriers must maximize customer satisfaction to enhance customer continuance intention. In particular, the empirical test analyzed the influence of system quality, contents quality, customer support, and compatibility factor as the antecedents of customer satisfaction across the full sample and the Android sample. As for iOS users, contents quality and compatibility had significantly positive influence on customer satisfaction. The analysis implicated that iPhone users showed high level of loyalty from contents and compatibility instead of expecting technological function of Apple products, whereas, Android users were interested in all the interactivity factors. Should the speed of network reach a certain level and functional differences among smartphones vanish after commercialization of 4G network, *contents quality*, would be a keystone of selecting telecommunication service.

Another interesting finding was the role of *network quality* construct. *Network quality* had direct and positive effect on continuance intention on both mobile platforms. This study verified that the improvement of quality of the 3G network would still strengthen interactivity of consumers and positively affect their continuance intention although telecommunication firms would lose ground in value chain of telecommunication market, prospected to be aggravated.

The following were the theoretical and practical contributions of this study. First, this study highlighted the elements of interactivity bridging technological and communication context aspects, and individual perception factors. We developed a theoretical framework that mainly focused on five dimensions of interactivity, including factors involved in using smartphones and reviewing literature and theories, which has been practiced until now. This study had implication as it tried to develop the potential quantification of interactivity levels.

Second, this study expanded the subject of interest of marketing paradigm in telecommunication service to mobile platform. The theory that excellent technological innovation spurs consumption has been prevalent at the technological determinism, but the study proved the distinctive attribute of interactivity and the causal relationship between satisfaction and continuance among open platform users and closed platform users, respectively. This implied that mobile carriers have to cover the whole value chain in the long term although the unleashing smartphone market brought expansion on new account profits and secured new momentum,

On the other hand, this study was not free from some limitations. Currently, it was hard to say that the sample was inappropriate when we considered the composition of users by main age group and their operating system, but a larger sample with more statistical power would be allowed for generalization in the future research. In this study sample might be somewhat biased for the 20s and the 30s. Further research should be tested by evidence from other age group including the 40s for generalization to represent total population. Second, cost, flow, and other factors, which can affect customer satisfaction were to be researched in the future study. At last, mobile OS was inclined to be expansively adapted to multi device platform such as tablet PC and smart TV as well as smartphone. Given the role of mobile operating system, it was necessary to expand research of platform-oriented smart device and information appliance continuously.

## <References>

- [1] Bae, J. and Jeong, H., "An Empirical Study on the Determinants Factors by Including Functional Attributes of Smart Phone Adoption," *The e-Business Studies*, Vol. 9, No. 4, 2008, pp. 337-361.
- [2] Bhattacharjee, A., "Understanding Information Systems Continuance: An Expectation-Confirmation Model", *MIS Quarterly*, Vol. 25, No. 3, 2001, pp. 351-370.
- [3] Chae, M., Kim, J., Kim, H., and Ryu, H., "Information Quality for Mobile Internet Services: A Theoretical Model with Empirical Validation," *Electronic Markets*, Vol. 12, No. 1, 2002, pp. 38-46.
- [4] Chau, Y.K. and Hu, J.H., "Information Technology Acceptance by Individual Professionals: A Model Comparison Approach," *Decision Science*, Vol. 32, No. 4, 2001, pp. 699-719.
- [5] Chen, J.V., Yen, D.C., and Chen, K., "The Acceptance and Diffusion of the Innovative Smart Phone Use: A Case Study of a Delivery Service Company in Logistics," *Information & Management*, Vol. 46, 2009, pp. 241-248.
- [6] Choi, D. and J. Kim, "Why People Continue to Play Online Games: In Search of Critical Design Factors to Increase Customer Loyalty to Online Contents," *Cyber Psychology and Behavior*, Vol. 7, No. 1, 2004, pp. 11-24.
- [7] Choi, L., "History of Mobile Handset and Smartphone Market," *SW Insight Policy Report*, Vol. 54, 2010, pp.1-69.
- [8] Cronin, J., Brady, M., and Hult, G., "Assessing the Effects of Quality, Value, and Customer Satisfaction on Behavior Intentions in Service Environments," *Journal of Retailing*, Vol. 76, No. 2, 2000, pp. 193-218.
- [9] Dorothy, L.B. and Deepak, K.S., "Developer-User Interaction and User Satisfaction in Internal Technology Transfer," *The Academy of Management Journal*, Vol. 36, No. 5, 1993, pp. 1125-1139.
- [10] Downes, E.J. and McMillan, S.J., "Defining Interactivity: A Qualitative Identification of Key Dimensions," *New Media and Society*, Vol. 2, No. 2, 2000, pp. 157-79.
- [11] Durlak, J.T, 'A Typology for Interactive Media', in M.L. McLaughlin (ed.) *Communication Yearbook 10*, pp. 743-57. Newbury Park, CA: Sage, 1987.
- [12] Gawer, A., *Platforms, Markets and Innovation*, Cheltenham, UK: Edward Elgar, 2009.
- [13] Gawer, A. and Cusumano, M.A., *Platform Leadership: How Intel, Microsoft, and Cisco Drive Industry Innovation*, Boston: Harvard Business School Press, 2002.
- [14] Hair, J. E., Anderson, R. E., Tatham, R. L., and Black, W. C., *Multivariate Data Analysis*, 5th Edition, New Jersey: Prentice-Hall, 1998.
- [15] Heeter, C., 'Implications of New Interactive Technologies for Conceptualizing Communication', in J.L. Salvaggio and J. Bryant (eds) *Media Use in the Information Age: Emerging Patterns of Adoption and Computer Use*, pp. 217-35. Hillsdale, NJ: Lawrence Erlbaum, 1989.
- [16] Jensen, J.F., "Interactivity: Tracing a New Concept in Media and Communication Studies," *Nordicom Review*, Vol. 19, 1989, pp. 185-204.

- [17] Jeong, J. and Jang, K., "A Study on the Factors of Smart-Phone Selection Centered on Actual Users," *The e-Business Studies*, Vol. 11, No. 4, 2010, pp. 361-379.
- [18] Jung, K.E. and Lee, D.M., "Reciprocal Effect of the Factors Influencing the Satisfaction of IS Users", *Asia Pacific Journal of Information System*, Vol. 5, No. 2, 1995, pp.199-226.
- [19] Kayany, J.M., Wotring, C.E., and Forrest, E.J., "Relational Control and Interactive Media Choice in Technology-Mediated Communication Situations", *Human Communication Research*, Vol. 22, No. 3, 1996, pp. 399-421.
- [20] Kim, H.C. and Kim, M.C. "An Empirical Study on the Effects of Service Quality in Mobile Telecommunication Service," *Korean Journal of Customer Satisfaction Management*, Vol. 1, No.1, 1999, pp. 1-20.
- [21] Kim, H.S. and Yoon, C.H., "Determinants of Subscriber Churn and Customer Loyalty in the Korean Mobile Telephony Market," *Telecommunication Policy*, Vol. 28, 2004, pp. 751-765.
- [22] Kim, J.K and Chang, S.G, "Typological Classification and Evolutionary Dynamics of Smartphone Ecosystems," *Telecommunications Review*, Vol. 21, No. 1, 2011, pp. 14-25.
- [23] Kim, M.K., Park, M.C., and Jeong, D.H., "The Effects of Customer Satisfaction and Switching Barrier on Customer Loyalty in Korean Mobile Telecommunication Services," *Telecommunication Policy*, Vol. 28, 2004, pp. 145-159.
- [24] Kim, S.H., "Moderating Effects of Job Relevance and Experience on Mobile Wireless Technology Acceptance: Adoption of a Smartphone by Individuals," *Information & Management*, Vol. 45, 2008, pp. 387-393.
- [25] Kioussis, S., "Interactivity: A Concept Explication", *New media and Society*, Vol.4, No.3, 2002, pp. 355-383.
- [26] Kuo, Y.F., "A Study on Service Quality of Community Websites," *Total Quality Management and Business Excellence*, Vol. 14, No. 4, 2003, pp. 461-473.
- [27] Kuo, Y.F., Wu, C.M., and Deng, W.J., "The Relationship among Service Quality, Perceived Value: Customer Satisfaction, and Post-purchase Intention in Mobile Value-added Services," *Computers in Human Behavior*, Vol. 25, 2009, pp. 887-896.
- [28] Lee, B.G., Yeo, K.Y., Kim, K.Y., and Lee, J. H., "Effects of Trust and Cognitive Absorption on Smart Phone Use and User Satisfaction," *Journal of Korea Information Processing Society*, Vol. 17-D, No. 6, 2010, pp. 471-480.
- [29] Lee, S., Ahn, J., Jahng, J., "The Effect of Perceived Interactivity's Mediator Role on Mobile Contents Users' Attitude and Behavioral Intention," *Asia Pacific Journal of Information Systems*, Vol. 16, No. 3, 2006, pp. 205-227.
- [30] Lee, Y.K, Lee, J.R., and Yoo, D., "The Structural Relationships between Interactivity, Identification, Relationship Quality, and Loyalty of e-Brand in Internet site", *Asia Pacific Journal of Information System*, Vol. 15, No. 4, 2005, pp. 1-26.
- [31] Mckinney, V., Yoon, K., and Zahedi, F., "The Measurement of Web-Customer Satisfaction: An Expectation and Disconfirmation Approach", *Information System Research*, Vol. 13, No.3, 2002, pp. 296-315.
- [32] McMillan S.J. and Hwang, J., "Measures of Perceived Interactivity" An Exploration of the Role of Direction of Communication, User Control, and Time

- in Shaping Perceptions of Interactivity,” *Journal of Advertising*, Vol. 31, No. 3, 2002, pp. 29-42.
- [33] Newhagen, J.E., Cordes, J.W., and Levy, M.R., "Nightly@NBC.Com: Audience Scope and the Perception of Interactivity in Viewer Mail on the Internet," *Journal of Communication*, Vol. 45, No. 3, 1996, pp. 164-175.
- [34] Nunnally, J.C., In: *Psychometric Theory*, 2nd edition. New York: McGraw-Hill, 1978.
- [35] Oh, S. and Bak, J., “The Satisfaction of Service Attributes and Intention of Continuous use of Smartphones”, *Telecommunications Review*, Vol. 21, No. 1, 2011, pp. 37-50.
- [36] Oliver, R.L., "A Cognitive Model of the Antecedents and Consequences of Satisfaction Decisions," *Journal of Marketing Research*, Vol. 17, No. 4, November 1980, pp.460-469.
- [37] Oliver, R.L., "Whence Consumer Loyalty?," *Journal of Marketing*, Vol.63, 1999, pp 33-44.
- [38] Park, I. and Shin, D., “Using the Used and Gratifications Theory to Understand the Usage and the Gratifications of Smart phones,” *Communication Science Research*, Vol. 10, No. 4, 2010, pp.192-225.
- [39] Park, Y., Chen, J.V., “Acceptance and Adoption of the Innovative Use of Smartphone,” *Industrial Management & Data*, Vol. 107, No. 9, 2007, pp.1349-1365.
- [40] Power, R.F. and Dickson, G.W., "MIS Project Management: Myths, Opinions, and Reality," *California Management Review*, Vol. 15, No. 3, 1973, pp. 147-156.
- [41] Rogers, E.M., *Diffusion of Innovation*. 3rd Edition, New York: Free press, 1983.
- [42] Shannon, C. and Weaver, W., *The Mathematical Theory of Communication*, Urbana, Illinois: University of Illinois Press, 1949.
- [43] Shneiderman, B. and Plaisant, C., *Designing the User Interface: Strategies for Effective Human-Computer Interaction*, 4th international edition, Boston: Addison Wesley, 2005.
- [44] Steuer, J.S., “Defining Virtual Reality: Dimensions Determining Telepresence,” *Journal of Communication*, Vol. 42, No. 4, 1992, pp. 73–93.
- [45] Swanson, B., "Management Information Systems: Appreciation and Involvement," *Management Science*, Vol. 21, No. 2, 1974, pp. 178-188.
- [46] Taylor, S. and Todd, P.A., “Understanding Information Technology Usage: A Test of Competing Model,” *Information Systems Research*, Vol. 6, No. 1, 1995, pp. 144-176
- [47] Wang, Y., Lo, H., and Yang, Y., “An Integrated Framework for Service Quality, Customer Value, and Satisfaction: Evidence from China’s Telecommunication Industry,” *Information Systems Frontiers*, Vol.6, No. 4, 2004, pp.325-340.
- [48] Wu, G., "Perceived Interactivity and Attitude toward Website," in *Proceedings of the American Academy of Advertising*, M.S. Roberts, ed., Gainesville, FL: University of Florida, 1999, pp. 254-262.
- [49] Yang, S., Lim, S., Lee, S., Lee, I., and Kim, J., “A Study on the Interaction Factors Influencing Use Intention of Interactive Video Services: Focusing on Timing Flexibility,” *Information System Review*, Vol.10, No. 2, 2008, pp.71-96.
- [50] Yin, J. and Straub, D., “The Interactivity of Internet-Based Communications: Impacts on E-Business Consumer Decisions,” *Proceeding of International Conference on Information Systems*, 2002, pp.661-665.

- [51] Youn, Y.S., Cho, B.S., and Ha, Y.W., "A Study on the Effect of Spectrum Difference between Cellular and PCS from Mobile Telecommunication Customer's Perspective", *Korean Journal of Technology Innovation*, Vol. 9, No. 4, 2006, pp. 627-653.
- [52] Zeithaml, V.A., Berry, L.L., and Parasuraman, A., "The Behavioral Consequences of Service Quality", *Journal of Marketing*, Vol. 60, 1996, pp. 31-46.

#### Appendix A. Questionnaire items

Construct	Item	Measurement	Reference
Compatibility	CP1	Using smartphone applications fits the way I work.	Taylor and Todd(1995), Chau and Hu (2001)
	CP2	Using smartphone applications does not fit my practice preferences.	
	CP2	Using smartphone applications fits my service needs.	
Satisfaction	ST1	My choice to buy this smartphone was a wise one.	Croin <i>et al.</i> (2000)
	ST2	I think I did the right thing when I subscribed to this smartphone service.	
	ST3	Overall, my feeling about this smartphone service is satisfactory.	
Continuance Intention	CI1	In the future, I will use smartphones and services provided by this telecom company again.	Zeithaml <i>et al.</i> (1996), Cronin <i>et al.</i> (2000), Wang <i>et al.</i> (2004)
	CI2	In the future, I will recommend smartphones and service provided by this telecom company to my relatives and friends.	
	CI3	In the future, I will continue to use the smartphone and services provided by this telecom company.	
Content quality	CQ1	This smartphone service provides appropriate content.	Kuo (2003), Kim <i>et al.</i> (2004), Yang <i>et al.</i> (2008)
	CQ2	This smartphone service provides important content.	
	CQ3	This smartphone service provides fashionable content.	
	CQ4	I can fully understand the content provided.	
Network Quality	NQ1	This telecom company provides clear and reliable voice calls.	Kim <i>et al.</i> (2004), Kuo <i>et al.</i> (2009)

	NQ2	Internet and voice calls of the smartphone are stable.	
System Quality	SQ1	The speed of the smartphone is fast	McKinny <i>et al.</i> (2002), Yang <i>et al.</i> (2008), Choi and Kim 2004), Kiousis (2002), Bhattacharjee (2001)
	SQ2	The vividness of the smartphone's screen and graphics are excellent.	
	SQ3	The performance of the smartphone device is stable.	
Customer Support	CS1	This telecom company provides diversified value-added services.	Chae <i>et al.</i> (2002), Kuo (2003), Kim <i>et al.</i> (2004)
	CS2	This telecom company provides multiple tariff options.	
	CS3	This telecom company provides good post-services.	
	CS4	When any problem occurs, the telecom company can instantly cope with it.	

#### Appendix B. Cross-loading results (Total)

	Network Quality	Compatibility	Contents Quality	Customer support	Continuance Intention	System quality	satisfaction
NQ1	<b>0.894</b>	0.120	0.268	0.197	0.343	0.312	0.222
NQ2	<b>0.893</b>	0.202	0.309	0.130	0.333	0.314	0.234
CP1	0.158	<b>0.904</b>	0.475	0.267	0.241	0.321	0.541
CP2	0.146	<b>0.883</b>	0.424	0.210	0.289	0.254	0.527
CP3	0.162	<b>0.794</b>	0.491	0.245	0.255	0.393	0.525
CQ1	0.282	0.436	<b>0.873</b>	0.207	0.420	0.408	0.551
CQ2	0.244	0.514	<b>0.876</b>	0.172	0.355	0.272	0.568
CQ3	0.197	0.419	<b>0.830</b>	0.129	0.314	0.340	0.429
CQ4	0.338	0.424	<b>0.764</b>	0.145	0.384	0.491	0.582
CS1	0.209	0.202	0.135	<b>0.798</b>	0.275	0.119	0.287
CS2	0.207	0.259	0.195	<b>0.755</b>	0.252	0.052	0.226
CS3	0.057	0.219	0.130	<b>0.792</b>	0.216	0.143	0.280
CS4	0.091	0.198	0.164	<b>0.779</b>	0.216	0.110	0.257
CI1	0.338	0.158	0.199	0.336	<b>0.763</b>	0.222	0.343
CI2	0.314	0.329	0.468	0.287	<b>0.909</b>	0.357	0.576
CI3	0.320	0.264	0.427	0.176	<b>0.864</b>	0.330	0.505
SQ1	0.326	0.330	0.427	0.081	0.317	<b>0.878</b>	0.403
SQ2	0.229	0.334	0.351	0.199	0.273	<b>0.810</b>	0.455
SQ3	0.321	0.259	0.352	0.050	0.317	<b>0.793</b>	0.318
ST1	0.238	0.521	0.608	0.317	0.558	0.474	<b>0.940</b>
ST2	0.231	0.623	0.568	0.295	0.497	0.376	<b>0.930</b>
ST3	0.248	0.592	0.633	0.335	0.548	0.489	<b>0.940</b>

\* NQ = Network Quality, CP = Compatibility, CQ = Contents Quality, CS = Customer Support, CI = Continuance Intention, SQ = System Quality, ST = Customer Satisfaction