

ATTRACTIVENESS OF ALTERNATIVES IN INFORMATION SYSTEMS CONTINUANCE: A CASE OF WiMAX

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ABSTRACT

WiMAX, commercialized for the first time in Korea in 2006. To attract WiMAX users, the WiMAX service provider, KT, offered a six month of free WiMAX services. After the six months, many users did not continue using WiMAX service but switched to other Internet access services. Not only attracting new users but also retaining existing users is crucial for the WiMAX business success. Previous research based on Information Systems (IS) continuance model explains the determinants of IS continuance mainly from the technology user perspective. However, a WiMAX user has double roles, technology user and service consumer. Rational economic assessment is essential for consumer decision makings. Marketing and economics literature explain that value assessment and comparison with alternatives are two main issues in rational economic assessment. This study examines WiMAX service continuance by integrating rational economic perspective and technology user perspective. The testing results based on the data collection from 200 WiMAX users show the significance of attractiveness of alternatives and user satisfaction in determining WiMAX continuance. Customer value further affects WiMAX continuance intention indirectly through user satisfaction. This study provides important implications for research by adding the rational economic assessment to the IS continuance model. This study also provides suggestions for practitioners regarding how to promote WiMAX continuance.

Keywords: WiMAX, IS continuance model, rational economic assessment, attractiveness of alternatives.

INSTRUCTION

WiMAX is the wireless broadband Internet services for mobile devices including laptops, cell phones, and smart phones. It is characterized by its high mobility and accessibility anytime and anywhere. WiMAX enables users to access Internet even when they are moving at speeds up to 120 km/h. After the Korea WiMAX standard was selected as a global standard by the Institute of Electrical Electronics Engineers (IEEE) in September 2005, the WiMAX service provider (KT) launched WiMAX service first in Korea in July 2006. As the number of users of smart phones and tablet PCs increases, WiMAX is expected to be the next generation for mobile communication and wireless Internet access.

To attract new WiMAX subscribers, KT offered a six month of free WiMAX services or other promotions such as free netbooks for WiMAX subscribers. However, after the six months or the contract period, many users were not resubscribing to WiMAX service and switched to alternative Internet access services [24] such as wired high-speed Internet. There are several wired and mobile Internet access

services. The low continuance rate of these users is a concern, because it directly impacts the performance of the mobile Internet service providers [20]. It has been studied that it costs five times more to acquire a new customer than to retain an existing one [12]. There is thus an impelling motivation for mobile Internet service providers to enhance the continuance of their service users.

However, most previous research on IS continuance [6] [23] [21] [35] focused on the technology user perspective. From this perspective, the technology attributes (e.g., usefulness together with the user experience with the technology (e.g., satisfaction) are the most important factors in determining the user's continuance decision [6]. WiMAX users, however, have dual roles, technology user and WiMAX service consumer. WiMAX users have to pay for the use of WiMAX services. Rational economic assessment is essential for consumer decision makings [34] [37]. There has been lack of consideration about rational economic assessment in previous research on IS continuance including the IS continuance model [6].

This study thus aims to examine IS continuance by adding the rational economic assessment from the service consumer perspective to the IS continuance model in the context of WiMAX. Marketing [34] [37] and economics [18] literature explain two assessments in consumer decision makings: value and comparison with alternatives. Value refers to the net benefits of target based on the comparison between benefits and costs [37]. Service consumers further compare between alternatives and choose better one in their decision makings [18] [34]. For the model of rational economic assessment, this study adopts the customer value theory [37] together with alternative comparisons [17]. The contributions of this study includes the theoretical advancement of IS continuance model. The findings also provide suggestions for WiMAX service providers regarding how to retain their WiMAX users.

The rest of the paper is organized as follows. The next section presents the conceptual background of this research. This is followed by the research model and hypotheses. We then describe the research methodology. After interpreting the empirical results, we discuss the theoretical and practical implications and conclude with a summary of this study.

CONCEPTUAL BACKGROUND

WiMAX and Alternatives

WiMAX is conceptualized as a wherever, whenever service available for mobile devices that connect to a high-speed wireless Internet during movement. WiMAX overlaps its position with other Internet services [27] [1]. When compared to Wideband Code Division Multiplex Access (WCDMA) and High Speed Downlink Packet Access (HSPDA) services, WiMAX's mobility and accessibility are relatively lower but

its speed in transmitting big size data such as video file is relatively higher. That is, the download speed of WiMAX is upto 24.8 Mbps (5.2 Mbps for upload) while that of HSDPA is upto 14.4 Mbps (2 Mbps for upload). HSDPA enables users to access Internet even when they are moving at speeds up to 250 km/h. Because W-CDMA and HSDPA are mainly used for Internet connection for cell phones or smart phones, it is installed in most smart phones as a basic function. In contrast, WiMAX is used not only for cell phones but also other mobile devices. Mobile devices and laptop computers require additional device (i.e., USB dongles) for the Internet connection through WiMAX. However, the usage fee of WCDMA and HSPDA is higher than WiMAX.

Compared to WiMAX, wireless LAN including Wi-Fi and wired-high speed Internet are limited by their mobility and usage coverage. Especially, wired high-speed Internet has no mobility although its speed in transmitting data including video is faster than other alternatives. Similarly, wireless LAN's data transmission speed (upto 600 Mbps) is faster than WiMAX. People can use wireless LAN for free in many cases. However, Wi-Fi users can access to the Internet within 120 meters from the nearest access point while WiMAX users can access within 1 kilometer from the nearest radio access station. For this reason, WiMAX is better than Wireless LAN in terms of accessibility. The service coverage of wireless LAN is relatively limited. WiMAX overcomes market limitations of existing mobile communication services by securing economic competitiveness and offering the same level of Internet access environment as fixed Internet service to various mobile devices including dongles (i.e., wireless broadband adapters). Because WiMAX offers Internet connection freely without reprocess contents, it opened a substantial combination of wire-wireless services, commercialized for the first time in Korea in 2006. It obtained 239,000 subscribers in July 2009 [25]. At that moment, WiMAX services were mainly focused on mobile Internet access, rather than content. Strong sales of the WiMAX service was delayed due to the narrow service coverage, limited device selection, and early reliability issues. Currently, WiMAX offers Internet access and data transmission services. Smartphones, dongles, WiMAX phones, mobile PCs, and PMP access services are offered by service providers with over 95% being smartphones and dongles. Today, the WiMAX service has extended its coverage nationwide in Korea, promoted new customers with a flat-rate, integrated with other Internet service providers and launched various mobile devices. As a result, subscribers of WiMAX have increased steadily from the 3rd quarter of 2007. Among those various reasons, it was analyzed that the flat-rate charge and the free dongles proved to increase the number of subscribers. However, its commercialization is still at the beginning stage.

WiMAX is known as Mobile WiMAX worldwide and is used in 27 nations with 2.3GHz (in US, Singapore, Australia and Korea) and 2.6GHz (in US, Netherland, Japan, and Taiwan) bandwidth. WiMAX is also selected as an international standard of 3rd generation (3G) mobile communication. Another advantage of WiMAX is that it uses the IP networks as its way of communication. Unlike wireless LAN, WiMAX overcomes the limitation of mobility. When we use a mobile phone network, it is hard to avoid the expensive fees. The WiMAX service can reduce these limitations by preempting the next mobile communication market. It does this by

integrating all IP networks with other mobile network systems and offer various services. WiMAX is also the most ideal service to develop high speed Internet service in developing countries for its wireless properties. Commitment.

Conceptual Framework

Because WiMAX users have double roles of technology user and service consumer, this study suggests an extension of the IS continuance model [6] by adding rational economic assessment of service consumers. IS continuance model has focused on explaining an individual user's continued usage of technology from the technology user perspective. The IS continuance model suggests that users' continuance intention is determined by user satisfaction and perceived usefulness of target technology. User satisfaction, in turn, is influenced by their confirmation of expectation from prior IS use and perceived usefulness. Perceived usefulness is influenced by users' confirmation level.

Based on the IS continuance model, there have been several research on the technology continuance. Most previous research examined several antecedents of IS continuance mainly from the technology user perspective and identified technology factors (e.g., perceived usefulness) and user experience with technology (e.g., satisfaction) as main antecedents of IS continuance (See Appendix1). Missing in previous research on IS continuance is the assessment of target technology from the rational economic perspective as a service consumer or buyer. Rational economic buyers are characterized by the value assessment of target [37] and the comparison between target and alternatives [17] [18] [34]. It is known customers are value-driven and they make a decision, i.e., choose one with higher attractiveness than alternatives [34].

Regarding value assessment, value means net benefits of target based on the comparison between benefits and costs [22] [37]. There are financial and non-financial benefits and costs. Previous research [20] shows that perceived value is a key determinant of mobile Internet service adoption by developing the Value based Adoption Model (VAM). In the context of mobile Internet services, benefits include usefulness and enjoyment while costs include fee for the service use and technicality [20]. In addition to value assessment, customers choose the one that offers higher utility than alternatives [34]. If the level of alternative attractiveness is higher than the target object, customers may not be willing to choose the target one. In the context of Internet access services, there are several alternatives including WiMAX as discussed before.

This study considers both rational economic perspective and technology user perspective in examining the antecedents of technology service continuance, i.e., WiMAX continuance. From the technology user perspective, this study selects perceived usefulness and satisfaction as the antecedents. From the rational economic perspective, this study selects perceived value and attractiveness of alternatives as the antecedents of technology service continuance.

RESEARCH MODEL AND HYPOTHESES

Based on the conceptual framework, we propose the research model presented in Figure 1.

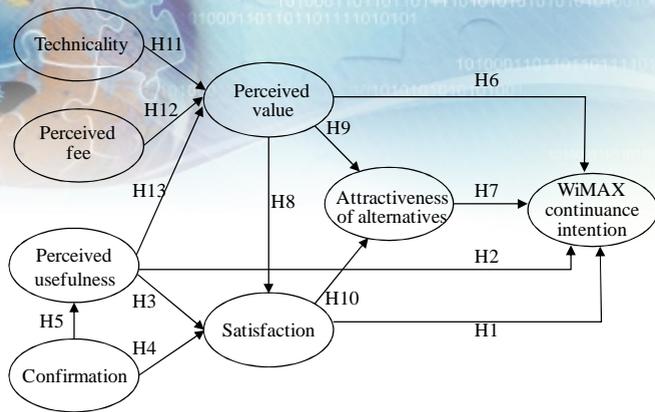


Figure 1. Research Model

From the technology user perspective, the IS continuance model [6] explains perceived usefulness, confirmation, and satisfaction as direct or indirect antecedents of WiMAX continuance intention. From the rational economic perspective, the VAM [21] explains perceived value, which is influenced by benefit factor (i.e., perceived usefulness) and cost factors (perceived fee and technicality), as a direct antecedent of WiMAX continuance intention. Because WiMAX is rather cognitive technology by mainly supporting Internet access (not contents) rather than hedonic one, we exclude enjoyment from the research model although the VAM includes enjoyment as a benefit factor. From the additional rational economic perspective, we suggest attractiveness of alternatives as another direct antecedent of WiMAX continuance intention.

IS continuance model [6] explains that perceived usefulness and satisfaction are the two main antecedents of IS continuance. IS continuance model further explains that expectation confirmation has a positive effect on the perception of usefulness and satisfaction. The model also explains the positive relationship between perceived usefulness and satisfaction. We propose the following five hypotheses based on the IS continuance model.

- H1: Satisfaction has a positive effect on WiMAX continuance intention*
- H2: Perceived usefulness has a positive effect on WiMAX continuance intention*
- H3: Perceived usefulness has a positive effect on satisfaction*
- H4: Confirmation has a positive effect on satisfaction*
- H5: Confirmation has a positive effect on perceived usefulness*

Zeithaml [37] explains that customers perceive what is received and what is given and then determine overall assessment of the utility (i.e., value) of target product or service. Perceived value thus refers to a consumer's overall perception of WiMAX based on the considerations of its benefits and sacrifices needed to use it. Following previous research [20] [37], we define perceived value as a *net benefit (perceived benefit via sacrifice) of the WiMAX service*. Service users try to maximize its utility and value in their decision makings and behaviors as part of a rational decision making process [34] [37]. For this reason, if the WiMAX service produces high value then the service users may want to continue using the service.

H6: Perceived value has a positive effect on WiMAX continuance intention

Rational economic decision makers assess not only the value of the target service but also its relative attractiveness in comparison with other alternatives [34]. Attractiveness of alternatives refers to “customer perceptions regarding the extent to which viable competing alternatives are available in the marketplace” [17]. Alternative attractiveness is conceptualized as the client's estimate of the likely satisfaction available in an alternative [30]. Attractiveness of alternatives thus means *customer perception regarding the extent to which alternative Internet access services are more attractive than WiMAX service*. There are several Internet access services (e.g., WCDMA/HSDPA, Wireless LAN, and Wired high speed Internet) other than WiMAX as we discussed before. WiMAX and other Internet services have different market positions in terms of fee, coverage and speed but they have ambiguous borders in market position due to well developed wire and wireless Internet service environment. For this reason, customer's comparative recognition in substitutes of WiMAX can affect the WiMAX continuance negatively. If alternatives have relative advantage in using Internet access services compared to WiMAX, users may switch to the attractive alternatives. In contrast, a lack of attractive alternative has been suggested to be a favorable situation to defend clients [30]. That is, relative advantage of target technology may influence the usage and continuance of the technology [19]. Attractiveness of alternatives may thus disturb the continuance of WiMAX negatively.

H7: Attractiveness of alternatives has a negative effect on WiMAX continuance intention

Satisfaction is considered as emotional response [8] [28]. Cognitive-evaluative process triggers satisfaction as emotional response [29]. Perceived value as a cognitive factor has rational structure to understand the discordance of benefit-sacrifice. Self-control process [3] and emotion/adaption theory [26] explain rational perception and assessment (i.e., perceived value) leads to the emotional responses (i.e., satisfaction). Perceived value of WiMAX service may thus affect user satisfaction with the service.

H8: Perceived value has a positive effect on satisfaction

Attractiveness of alternative Internet access services can be increased as the value (i.e., net benefits) of alternatives increases or as the value of target WiMAX service decreases. For example, if alternative Internet access services are available with higher value (e.g., lower cost, high performance, and greater convenience) then the attractiveness of WiMAX service would be lowered. In contrast, high value of WiMAX service may increase the attractiveness of the service which may, in turn, lower attractiveness of alternatives. Similarly, if users are satisfied with WiMAX service, they may perceive high level of attractiveness of the service, which may in turn lower attractiveness of alternatives. Perceived value and satisfaction are cognitive assessment and emotional assessment of the target WiMAX service respectively without comparison with alternatives. These two cognitive and emotional assessments may thus affect relative

attractiveness of WiMAX service and then attractiveness of alternatives.

H9: Perceived value has a negative effect on attractiveness of alternatives

H10: Satisfaction has a negative effect on attractiveness of alternatives

This study identified two sacrifice factors and one benefit factor as the antecedents of perceived value. As a sacrifice factor, technicality means the degree to which WiMAX is perceived as being technically excellent in the process of providing services [20]. As the level of technicality decreases, WiMAX users have to sacrifice their time and efforts more in using WiMAX service. In contrast, as the level of technicality increases, the users would be able to spend less time and efforts in using the service. Technicality thus may affect overall value perception [20].

As another sacrifice factor, this study identifies perceived fee. Perceived fee symbolizes the encoding or internalization of the objective usage fee of service. The fee structure of WiMAX consists of the pay-as-you-use scheme and subscription-based pricing. Jacobby and Olson [16] distinguish between the objective price and the price encoded by customers (i.e., perceived price). Customers usually do not remember the objective price [37]. Instead of having perfect information about prices, customers possess internal reference prices and make comparison with these prices [11]. They encode prices in ways meaningful to them, whose outcomes drive the price perception of customers [16]. In the case of WiMAX service, customers would probably compare the fee with other reference prices such as the usage fee of alternative Internet access services and encode the fee as high or low. As the perceived fee increases, the overall value of WiMAX service may decrease. Perceived fee may thus reduce perceived value [20].

Perceived usefulness has long been identified as a key benefit factor motivating the adoption and continuance of technology [6]. In addition to the direct effect of perceived usefulness, we propose the indirect effect of perceived usefulness on continuance through overall value assessment. There are several benefit factors i.e., job-fit, outcome expectations, relative advantage, extrinsic motivation, and performance expectancy [36]. Because overall value (i.e., perceived value) is assessed based on the comparison between benefits and costs, benefit factors affect the value perception. Perceived usefulness of WiMAX service may thus increase overall value of WiMAX service [20].

H11: Technicality has a positive effect on perceived value

H12: Perceived fee has a negative effect on perceived value

H13: Perceived usefulness has a positive effect on perceived value

RESEARCH METHODOLOGY

Data empirically validate the research model of Figure 3 were collected through a field survey using a questionnaire. We also collected qualitative data by conducting interviews with 20 WiMAX users and 2 industry experts. According to the interview results, people adopt WiMAX because of its several benefits such as mobility, convenience, and low fee. They also mentioned limitations of WiMAX such as

inaccessibility to WiMAX at some places, low speed in playing video files, and additional USB modem for the Internet access. Compared to alternative Internet access services, interviewees mentioned lower speed than wired Internet access services and limited coverage but more convenience compared to wireless Internet access services. The interviews also assisted in the interpretation of specific survey results.

Instrument Development

To develop the survey instrument, we adopted existing validated scales wherever possible. We adapted the items for WiMAX continuance intention, satisfaction, perceived usefulness, and confirmation from Bhattacharjee [6] by considering the WiMAX service context. We also adapted the items for perceived value, technicality, and perceived fee from Kim et al. [20]. To assess attractiveness of alternatives, we adapted scales from Jones et al. [17]. Alternatives in this study mean other Internet access services than WiMAX. The construct of technicality is considered formative because it is a composite of multiple indicators. In contrast, the other constructs are considered reflective because they are each uni-dimensional and exclusion of an indicator does not alter the construct's meaning.

Two IS researchers reviewed the instrument for its face validity. Feedbacks on the questionnaire also were obtained from five WiMAX users with regard to any ambiguity of the questions, the length of the instrument, the format of the scales, and the information to be sought from respondents. The final measurement items are presented in the Appendix2. All measurement items were anchored on the seven-point Likert scale (1=strongly disagree, 7=strongly agree).

Data Collection

We selected KT as the context of our study because it is a successful WiMAX service provider in the Korean market. Although WiMAX service providers such as Clear in the U.S., iBurst in South Africa or Aria in Italy, are similar international mobile Internet service providers, KT gives us more distinct comparativeness to other Internet service providers due to the well saturated Korean market. With the help from the marketing manager of KT, we randomly selected 800 WiMAX subscribers and invited for the survey. E-mails were sent out via KT WiMAX to the selected subscribers. We explained the purpose of this research and the contents of the survey.

A total 202 responses were collected over two weeks. After dropping two incomplete responses, 200 responses were used for data testing (see Table 1). The respondents have used the WiMAX Internet services for 16.13 months on average. They have used the services in different level of frequencies: more than 10 times a day (5.0%), between 1-9 times per day (44.5%), 1-6 times per week (40.5%), 1-3 times per month (6.0%), and less than 1 time per month (4.0%). Most respondents are professionals (84.0%) in thirties (28.5%) and forties (43.0%).

Table 1. Descriptive statistics of respondents

Demographic variable	Frequency	Percentage
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Gender	Male	155	77.50
	Female	45	22.50
Age	10-19	1	0.50
	20-29	32	16.00
	30-39	57	28.50
	40-49	86	43.00
	50-59	24	12.00
Job	Student	26	13.00
	Professional	168	84.00
	Housewife	3	1.50
	Others	3	1.50
Total		200	100.00

We evaluated the non-response bias by comparing early and late respondents, i.e., those who replied during the first week compared to those who responded in the second week of the data collection period. T-tests demonstrated that the early and late respondents did not differ significantly ($p < 0.01$) in terms of age and WiMAX experience. The results of the Mann-Whitney tests also showed no significant differences ($p < 0.01$) in the gender ratios of the two respondent groups. We further assessed the comparison between the sample and the registered subscriber database of the company. T-tests show that the sample and the population of registered subscribers did not differ significantly.

DATA ANALYSIS AND RESULTS

Instrument Validation

We carried out data analysis in accordance with a two-stage methodology [2]. PLS was chosen for the data analysis because it can account for structural models with both formative and reflective constructs [7]. To validate the survey instrument, we performed confirmatory factor analysis. We first assessed convergent and discriminant validity of the constructs. For the formative construct (i.e., technicality), absolute item weights were checked to determine the relative contribution of items constituting the construct [7]. All items weights ($TEC1 = 0.40$, $TEC2 = 0.32$, and $TEC3 = 0.36$) were significant at the 0.05 level. Multicollinearity among the indicators of technicality was also assessed by calculating variance inflation factor. The results did not indicate any problem.

As for the other reflective constructs, the standard path loadings were all significant ($t\text{-value} > 1.96$) and greater than 0.7 (See Table 2). The Composite Reliability (CR) and Cronbach's α for all constructs exceeded 0.7. The average variance extracted (AVE) for each construct was greater than 0.5. The convergent validity for the constructs was supported.

Table 2. Psychometric Properties of Reflective Constructs

Construct	Item	Std. Loading	AVE	CR	Cronbach's α
FEE	FEE1	0.92	0.89	0.96	0.94
	TEE2	0.95			
	FEE3	0.97			
VAL	VAL1	0.85	0.85	0.96	0.96

USF	VAL2	0.96	0.91	0.98	0.96
	VAL3	0.95			
	VAL4	0.92			
	USF1	0.95			
CNF	USF2	0.95	0.93	0.97	0.95
	USF3	0.96			
	USF4	0.97			
	CNF1	0.96			
SAT	CNF2	0.97	0.87	0.97	0.95
	CNF3	0.96			
	SAT1	0.91			
	SAT2	0.96			
ATT	SAT3	0.95	0.88	0.96	0.95
	SAT4	0.92			
	ATT1	0.91			
CNT	ATT2	0.94	0.90	0.97	0.93
	ATT3	0.96			
	CNT1	0.97			
	CNT2	0.95			
	CNT3	0.93			

We then assessed the discriminant validity of the measurement model by comparing the square root AVE for each construct with the correlations between the construct and other constructs. If the square root of AVE is greater than the correlations between the construct and other constructs then it indicates the discriminant validity [10]. As shown in the Appendix3, the square root of AVE for each construct (diagonal term) exceeded the correlations between the construct and other constructs. Hence, discriminant validity of the instruments was supported.

We tested for multicollinearity among constructs. In all cases, the variance inflation factor was below 10 and condition index was less than 30, indicating that multicollinearity is not likely to distort testing results in our study [13]. We also tested our data for common method variance using the Harman's single-factor test [14]. The threat of common method bias is high if a single factor accounts for more than 50 percent of the variance. Results of the test indicate that our data do not suffer from common method variance.

Hypotheses Testing

We tested the hypotheses by applying the bootstrapping re-sampling technique. Results of the structural model analysis are shown in Figure 2. Satisfaction (H1) and attractiveness of alternatives (H7) were found to have significant effects on WiMAX continuance intention, explaining 54 percent of its variance. Technicality (H11), perceived fee (H12), and perceived usefulness (H13) were found to have significant effects on perceived value, explaining 69 percent of its variance. Perceived value (H8) and confirmation (H4) were found to have significant effects on satisfaction, explaining 51 percent of its variance. Confirmation (H4) also was found to have a significant effect on perceived usefulness, explaining 42 percent of its variance. However, we could not find significant direct effects of perceived value (H6) and perceived usefulness (H2) on WiMAX continuance intention. We also could not find a significant direct effect of perceived usefulness (H3) on satisfaction.

We further tested whether the effect of perceived value on

WiMAX continuance intention is mediated by satisfaction following the guidelines suggested by Baron and Kenny [4]. Perceived value has a significant effect on the continuance (path coefficient = 0.21, $t = 2.28$) when satisfaction was

removed from the structural model. The effect, however, becomes insignificant when satisfaction was added to the model as in Figure 2. The effect of perceived value on the continuance is therefore fully mediated by satisfaction.

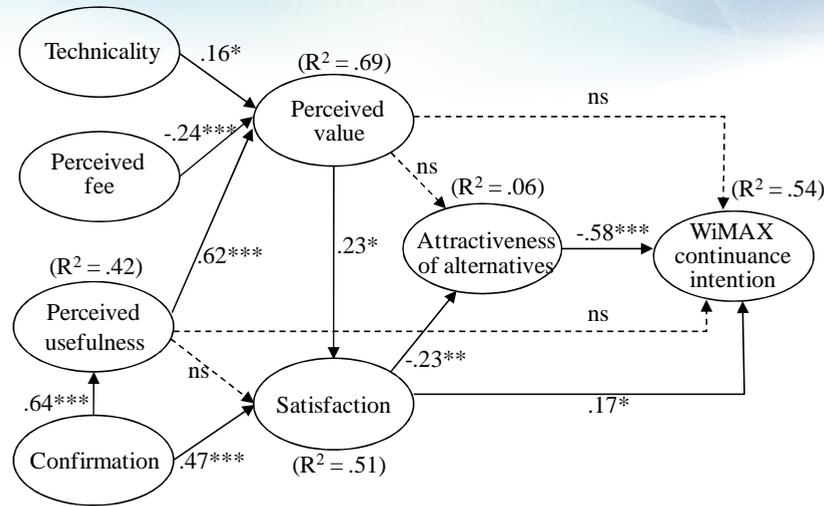


Figure 2. Structural Model Testing Results

(*: $p < 0.05$, **: $p < 0.01$, ***: $p < 0.001$, ns: insignificant at the 0.05 level)

DISCUSSION

Discussion of findings

This research resulted in several salient findings. The key finding in this study is the significant antecedent of WiMAX continuance from the rational economic perspective. The findings show the significant effect of attractiveness of alternatives on the continuance intention. Internet service provider market is already saturated in Korea by many Internet access services including wired and wireless Internet access services. As a service consumer, Internet access service users may compare alternatives and choose or switch to a better choice. Even the current WiMAX users may discontinue the use of WiMAX service if they perceive relatively higher attractiveness of alternatives in comparison with WiMAX service. Similar to this finding, Jones et al. [17] explained that lower attractiveness of competing alternatives is associated with higher repurchase intentions in their marketing research. Many interviewees have ideas that there are several approaches for Internet access, wired or wireless. One interview mentioned that: “there is little special relative attractiveness of WiMAX compared to other Internet access services.” The other interviewee noted that: “I can use wire and wireless LAN to access to the Internet. I do not have any needs of the WiMAX service.”

This study also found the significant antecedent of WiMAX continuance from the technology user perspective. As Bhattacharjee [6] explained in his IS continuance model, the findings show the significant effect of user satisfaction on the continuance intention. Similarly, it is known that customer satisfaction is a key determinant of customer retention in marketing literature [31].

However, this study could not find the significant effect of perceived usefulness on WiMAX service intention, which is in conflict with the IS continuance model [6]. The post-hoc analysis shows the effect of perceived usefulness is fully

mediated by perceived value. When we drop the relationship between perceived value and WiMAX continuance intention, perceived usefulness becomes to have a significant effect on the continuance intention (path coefficient = 0.17, $t = 2.56$). Perceived usefulness is a cognitive belief while perceived value is a cognitive overall assessment (i.e., net benefits). It seems that all three beliefs (i.e., perceived usefulness, perceived fee, and technicality) are captured in the cognitive overall assessment, perceived value. Similarly, this study could not find a significant effect of perceived usefulness on satisfaction, which is in conflict with the IS continuance model. The post-hoc analysis shows the effect of perceived usefulness on satisfaction is fully mediated by perceived value. When we drop the relationship between perceived value and satisfaction, perceived usefulness becomes to have a significant effect on satisfaction (path coefficient = 0.22, $t = 2.89$).

The significant effect of perceived value on satisfaction is in line with self-control process [3] and emotion/adaption theory [26]. However, this study could not find the significant effect of perceived value on the continuance intention directly while perceived value has been identified as a key determinant of mobile Internet service adoption [20]. Similarly, interviewees noted the importance of value in the adoption of WiMAX by mentioning that: “when I decide the adoption of WiMAX, the cost-benefit analysis is important for the decision making.” They noted the different importance of value in their continuance decision making by mentioning that: “while the cost-benefit analysis is important for the first decision making, it is not so important when I decide to continue using the WiMAX or.”

Instead, the findings show the indirect effect of perceived value through satisfaction. Value is cognitive assessment [20] [37] while satisfaction is emotional response or affective assessment [9] [28]. This is an interesting finding because many companies adopt emotion marketing these days. Although rationality (i.e., perceived value) as cognitive

response affects emotion (i.e., satisfaction) as affective response, the findings could not find the direct relationship between cognitive response and WiMAX continuance intention while affective response has a directly significant effect on the intention. This finding supports the importance of emotion marketing [32].

The findings of this study, however, should be interpreted in the context of its limitations. First, this study has been conducted based on data and observations from a single nation, South Korea. More research is needed to examine the robustness and generalizability of the findings across the diverse context. Second, this study was conducted based on cross-sectional data. Future study can adopt a longitudinal study and test the model across stage from adoption and post-adoption. Next, the findings are mainly based on the perception data. Future study can use objective data as well as perception data in developing and testing the research model.

Implications for Research

There are several implications for research. First, this study adds to the previous research on IS continuance by explaining the significant role of attractiveness of alternatives in determining IS continuance. Previous research has explained the significant effects of the perceived characteristics of target technology or user experience with target technology on IS continuance such as perceived usefulness [6], perceived ease of use [23], perceived enjoyment [35], pleasure [20], self-efficacy [15], attitude [19], satisfaction [6]. There has been little research on the effect of comparison with alternatives on the technology continuance. This study is the first one showing the significant effect of attractiveness of alternatives on IS continuance.

Second, this study has adopted the theoretical background of consumer decision makings [34] [37] in examining IS continuance. Most previous research (e.g., [6] [15] [35]) has adopted the expectation-confirmation theory or theory of planned behaviour in examining IS continuance by taking the technology user viewpoint. According to consumer decision making models [34] [37], consumers evaluate net benefits (i.e., cost-benefit analysis) and compare the net benefits with alternatives in their decision makings. The WiMAX users have dual roles, technology users and service consumers. This study thus has a contribution in combining the viewpoints from technology user and service consumer in examining IS continuance.

Next, this study shows different roles of cognitive assessment (i.e., perceived value) and affective assessment (i.e., satisfaction) in IS continuance. This study found a significant role of satisfaction as affective assessment in determining IS continuance directly. This study also found a significant role of perceived value as cognitive assessment in mediating the effects of cognitive beliefs (e.g., perceived usefulness) and affecting user satisfaction. The post-hoc analysis shows that satisfaction fully mediates the effect of perceived value on the continuance intention and the effect of perceived value on attractiveness of alternatives.

Implications for Practice

There are also several implications for practice. Because WiMAX is the first commercialized 3G mobile Internet

service, there are very little studies and researches that show real evidence or data about WiMAX service and continuance usage. Based on the findings in this study, WiMAX service providers can make a strong strategy in launching and continuing their service to their users. First, the findings explain the important role of attractiveness of alternatives. That is, retaining relative attractiveness in comparison with alternatives is important in increasing WiMAX continuance, especially in the well developed telecommunication environment. There are several Internet access services with different characteristics as discussed in the conceptual background. Users may choose one or multiple Internet access services depending on their needs. One interviewee noted that "there are lots of Internet service vacant areas with WiMAX." The other interviewee complained that "the speed of WiMAX is slower than other Internet access services." Regarding the continuance of WiMAX, some interviewees commented that "if we can use all Internet access services with one equipment" and "with wider service coverage" and "if the disconnection problems are solved with higher speed," "we may highly use WiMAX." To grasp the continuance usage in WiMAX services, it is important to make easier Internet access and higher service quality, solving the disconnecting problems, and broadening service coverage. Internet service providers also can consider developing bundling package with multiple Internet access services. Currently, those alternatives for Internet access are considered as being competing each other. They can, however, complement each other depending on the user's needs, tasks, and location.

Next, this study highlights user satisfaction and emotional marketing in WiMAX continuance. According to the interview with the industry experts, KT has focused on improving the technical quality and service fee for promoting WiMAX. In contrast, the findings explain the necessity of emotional marketing. As a way for emotional marketing strategies, enhancing user satisfaction should be a key element. This study explains that user satisfaction can be improved by net benefits of WiMAX service. Thus, it is essential to increase the value by improving the usefulness of WiMAX service, enhancing the technicality, and lowering the WiMAX usage fee. It is helpful to maintain standard monthly fee that customers can accept and to subsidize Internet devices such as netbooks or smartphones.

CONCLUSION

Many technology users including WiMAX have dual roles, technology user and service consumer. Most previous research on IS continuance focused on identifying the key characteristics of target technology and user experience with it in identifying the antecedents of IS continuance. Little research has considered rational economic assessment from the service consumer perspective in examining IS continuance. Two key elements in service consumer decision makings are value assessment and the comparison with alternatives. Going beyond previous research on IS continuance, as a key contribution, this study examined IS continuance by combining rational economic viewpoint and technology user viewpoint in the context of WiMAX. Especially, the findings of this study highlight the importance relative attractiveness of target technology (i.e., attractiveness of alternatives) and emotional marketing (i.e.,

user satisfaction) in promoting IS continuance. This study also provides several implications for Internet access service

providers regarding how to retain WiMAX users.

APPENDIX 1: SUMMARY OF PREVIOUS RESEARCH ON IS CONTINUANCE

Researcher	Context	Background Theory	IS continuance factors
Bhattacharjee(2001a)	Online brokerage	Expectation-confirmation theory	Perceived usefulness, satisfaction, and the interaction between perceived usefulness and the loyalty incentives
Bhattacharjee(2001b)	Online banking	Expectation-confirmation theory	Perceived usefulness and satisfaction
Hsu & Chiu(2004)	Web-based tax filing services	Theory of planned behavior	Internet self-efficacy and satisfaction
Karahanna et al.(1999)	Microsoft's Windows 3.1 software package	Theory of reasoned action	Attitude toward using the IS and perceived voluntariness
Kim & Malhotra(2005)	Personalized portal website of a university	Technology adoption model	Perceived usefulness, perceived ease of use, and past use
Kim et al.(2007)	M-Internet service		Usefulness, attitude, and pleasure
Roca et al.(2006)	E-learning service	Expectation-confirmation theory	Satisfaction
Thong et al.(2006)	M-Internet service	Expectation-confirmation theory	Perceived usefulness, perceived ease of use, satisfaction, and perceived enjoyment

APPENDIX2: MEASUREMENT INSTRUMENT

Variable	Item	Wording	Reference
Technicality (TEC)	TEC1	It is easy to use WiMAX.	Kim et al. (2007)
	TEC2	WiMAX has no disconnection during usage.	
	TEC3	WiMAX takes a short time to respond.	
	TEC4	WiMAX is anytime available.	
Perceived fee (FEE)	FEE1	The fee that I have to pay for the use of WiMAX is too high.	Kim et al. (2007)
	FEE2	The fee that I have to pay for the use of WiMAX is reasonable (reversed).	
	FEE3	I am pleased with the fee that I have to pay for the use of WiMAX (reversed).	
Perceived Value (VAL)	VAL1	Considering the fee I need to pay, the use of WiMAX offers value for money.	Kim et al. (2007)
	VAL2	Considering the effort I need to put in, the use of WiMAX is beneficial to me.	
	VAL3	Considering the time I need to spend, the use of WiMAX is worthwhile to me.	
	VAL4	Overall, the use of WiMAX delivers me good value.	
Confirmation (CFM)	CFM1	My experience with using WiMAX was better than what I expected.	Bhattacharjee (2001b)
	CFM2	The service level provided by WiMAX was better than what I expected.	
	CFM3	Overall, most of my expectations from using WiMAX were confirmed.	

Perceived usefulness (USF)	USF1	Using WiMAX improves my performance in doing what I want.	Bhattacharjee (2001b)
	USF2	Using WiMAX enhances my effectiveness in doing what I want.	
	USF3	Overall, WiMAX is useful in performing what I want.	
Satisfaction (SAT)	How do you feel about your overall experience of WiMAX use?		Bhattacharjee (2001b)
	SAT1	Very dissatisfied/Very satisfied	
	SAT2	Very displeased/Very pleased	
	SAT3	Very frustrated/Very contented	
WiMAX Continuance intention (CNT)	SAT4	Absolutely terrible/Absolutely delighted	Bhattacharjee (2001b)
	CNT1	I intend to continue using WiMAX rather than discontinue its use.	
	CNT2	My intentions are to continue using WiMAX than use any alternative Internet access services.	
Attractiveness of Alternatives (ATTT)	CNT3	If I could, I would like to discontinue my use of WiMAX (reverse coded).	Jones et al. (2000)
	ATT1	If I needed to change Internet access services, there are other good services to choose from.	
	ATT2	I would probably be happy with other Internet access services than WiMAX.	
	ATT3	Compared to WiMAX, there are other Internet access services with which I would probably be equally or more satisfied.	

APPENDIX3: CORRELATIONS BETWEEN LATENT CONSTRUCTS

	Mean	SD	CNT	SAT	VAL	REL	TEC	FEE	USF	CNF
CNT	4.63	1.44	0.95							
SAT	4.54	1.23	0.44	0.93						
VAL	4.75	1.29	0.40	0.62	0.92					
ATT	3.95	1.50	-0.66	-0.27	-0.18	0.94				
TEC	4.54	1.18	0.34	0.66	0.60	-0.19	NA			
FEE	3.59	1.36	-0.21	-0.33	-0.50	0.16	-0.30	0.94		
USF	4.87	1.24	0.37	0.57	0.78	-0.16	0.54	-0.34	0.95	
CNF	4.46	1.39	0.46	0.68	0.68	-0.22	0.68	-0.33	0.65	0.96

(Note: Leading diagonal shows the squared root of AVE of each construct. AVE is not calculated for formative construct)

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