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**Determining the Antecedents to Use Intention in the Area of  
Telecommunication-Broadcasting Convergence**

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## Abstract

*The convergence of telecommunication and broadcasting is one of the representative innovative technologies in digital environment. It has recently been empathized as an alternative solution to overcome already saturated telecommunication and broadcasting markets. However, the growth of related service and market cannot reach prior expectation due to the lack of understanding on the real users.*

*Telecommunication technologies support users' instrumental purpose and broadcasting services usually serve their entertainment activities, which have an inherent value. Our research question is which factors influence users' attitude and decision making in the use of convergence services in the area of telecommunication and broadcasting. To access the determinants, we propose hedonic and utilitarian values as intrinsic and extrinsic motivators, and perceived control as internal and external conditions.*

*To verify our model empirically, we have selected the DMB technology, a good example for the distinctive convergence service of telecommunication and broadcasting. In order for the DMB service to differentiate itself from the existing media and create unique benefits as a business model, service providers must develop individually customized contents based on each user's context information and life style and deliver them with the format meeting their hedonic needs and demands.*

**Keywords:** Digital Convergence, Convergence of Telecommunication and Broadcasting, Perceived Hedonic Value, Perceived Utilitarian Value

## 1. Introduction

Nowadays, the term “convergence” is creating a new paradigm across various fields including economy, politics, culture and technology. The cross effect of each individual technology has dramatically changed human life (Fidler, 1997). Its representative example is the convergence of telecommunication and broadcasting that has recently been proposed as an alternative solution to overcome the limit of already saturated telecommunication and broadcasting markets. New services on the border with other areas including DMB, VOD, IP-TV, and data broadcasting have been developed and provided. Especially, DMB was designated as one of eight services of u-IT 839 strategy of the Korean government and it is evaluated as a growth power that can promote the domestic IT industry and increase Korea's competitive edge. The service is expected to bring a ripple effect of 14.7 trillion won (about USD 15 billion) in the national economy and create 163,000 jobs until 2010 (ETRI, 2004).

Digital Multimedia Broadcasting (DMB) is a mobile multimedia broadcasting service which provides users with high-quality audio and video contents over handheld devices on the move (the maximum speed of 200 km/h) by using digital broadcasting technology. It is classified into terrestrial DMB (T-DMB) and satellite one (S-DMB) by transmission

channels. In Korea, TU Media started to offer S-DMB in May, 2005 and the consortium of KBS, MBC, SBS, YTN, and U1 Media launched T-DMB on December 1, 2005.

Though Korea has commercialized both S- and T-DMB before any other countries in the world, the absence of efficient business models, regulation policy and conflicts among market participants make the growth of the market difficult. Nevertheless, the more serious problem is the lack of understanding on the behaviors of actual users.

Several existing researches on DMB examined the standardization and technical trend of S- and T-DMB focused on political or technical perspectives. There have been a few studies about the revitalization plan of the market or the characteristics of potential demand toward the Korean market (Byeon, 2004; Ji et al., 2005; Korea Radio Station Management Agency, 2004; Park, 2004). Academic or practical fields seldom try to consider the factors affecting the DMB usage directly or even indirectly.

This paper examines the factors determining the adoption of DMB service, one of new and leading-edge convergence services in Korea nowadays, through the literature survey and an empirical test in terms of people's behaviors and technology acceptance. The results of this research can set a guideline to establish a positioning strategy for related participants in the early market.

## **2. Literature Review**

### ***2.1 Perceived Hedonic Value and Perceived Utilitarian Value***

The motivation theory (Deci, 1975; Deci and Ryan, 1987) classifies drivers of behavior into intrinsic motivator such as enjoyment or fun and extrinsic motivator caused by external reward. Intrinsic motivation means the pleasure and satisfaction caused by a specific activity itself while extrinsic motivation focuses on performing a behavior to achieve a specific goal. These concepts have been redefined as hedonic value and utilitarian values as two dimensions of individual attitude that have been much investigated in various fields including sociology and psychology.

Holbrook and Hirschman (1982) emphasized 'pleasure-oriented consumption' and identified it as an experiential view that has rarely been considered in information processing model. The information processing model focuses on utilitarian function based on objective characteristics of a product or service while experiential perspective concentrates on hedonic value. Many studies on pleasure-oriented consumer activities have been investigated since their research (Babin et al., 1994; Batra and Ahtola, 1990; Spangenberg et al., 1997; Voss, 2003).

External motivation determining a consumer's purchase activities or attitude is a similar concept to cognitive usefulness in TAM (Technology Acceptance Model) (Davis et al., 1992; Venkatesh, 1999). The model is based on TRA (Theory of Reasoned Action) explains perceived usefulness and ease of use affect user's intention to accept or use a new technology. In addition, Davis et al. (1992) added perceived enjoyment, an intrinsic motivator to the model.

Hedonic value for adopting refers the extent to which fun and enjoyment can be derived from using a technology or system. The value gives intrinsic psychological rewards to users. A user experiences direct and immediate pleasure and enjoyment from using a system is likely to use it more extensively than others regardless of any anticipated performance outcome. Thus, the user is likely to use the system more extensively than other systems (Davis et al., 1992; Heijden, 2004, Igarria et al., 1994; Igarria et al., 1996; Moon and Kim, 2001; Venkatesh, 1999; Webster and Martocchio, 1992).

Moon and Kim (2001) extended TAM to Web context and proposed perceived playfulness including concentration, curiosity, and enjoyment as an intrinsic motivator based on Barnett's researches (1990, 1991). Moreover, they distinguished users into the entertainment group and work group according to their purpose in the use of Web and compared the effect of perceived playfulness and perceived usefulness between these two groups. They discovered that perceived playfulness had significant effects on both groups while perceived usefulness had significant influence only on work-purpose group.

Chae et al. (2002) introduced the purpose of usage as a mediated variable to measure the quality of mobile Internet service. He assumed that the user with the utilitarian purpose pursues specific information while the one with the hedonic purpose enjoys using the system without any substantial goal. Heijden (2004) distinguished utilitarian systems to provide users with instrumental value and hedonic systems to provide them with self-fulfilling value. Hedonic systems aim continuous usage by making users have a pleasurable experience as using systems while utilitarian systems strive to improve task performance by increasing efficiency or productivity. He insisted that perceived enjoyment and perceived ease of use have stronger effect on intention to use more than perceived usefulness does in hedonic information system environment.

## ***2.2 Perceived Control***

Although a system or service can satisfy users' requirements and they are well motivated intrinsically and extrinsically, they probably show actual behaviors and usage depending on non-motivational factors such as available resources and opportunities (e.g., time, money, skills, and cooperation with others) (Ajzen, 1991). Those who can access and use the resources and opportunities may have stronger intention than others and succeed in doing so. In other words, user confidence in own ability to use a system or service forms positive attitude and evaluation toward one.

Bandura (1977, 1982) organized the Self-Efficacy Theory and proposed the concepts, outcome expectation and efficacy expectation. They refer to the perceived ability of organizing and performing a specific task successfully. Outcome expectation is associated with perceived usefulness in TAM and efficacy expectation can be regarded as perceived ease of use (Venkatesh et al., 2003).

Moreover, self-efficacy is compatible with perceived behavior control in TPB (Theory of Planned Behavior), referring the extent to perform a behavior with the ease of difficulty (Ajzen, 1991). If users have identical behavior intention, one with the higher self-efficacy

is likely to realize his/her intention. In particular, even though there is identical intention to use a new information system, a user with confidence in using new technology does more using and is more skillful than other users are.

Taylor and Todd (1995) pointed out the limitation of TAM which did not consider perceived ability and control and compared explanatory power of TPB and TMA. They decomposed perceived behavior control into facilitating conditions and self-efficacy. The former is the availability of resources that is necessary to engage in a behavior such as time, money, or other specialized resources. The latter is an individual's self-confidence in his/her own ability to perform a behavior. We conceptualize perceived control comprehending ease of use in TAM, efficacy, and facilitating conditions. They are internal and external conditions for IT usage.

### **3. Methodologies**

#### ***3.1 Research Model and Hypotheses***

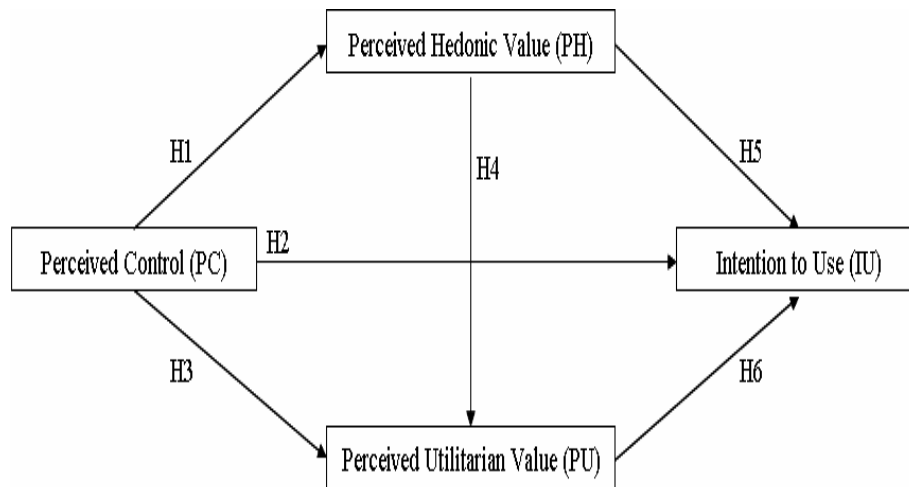
Perceived utilitarian can be derived from extrinsic outcome such as improving job performance, productivity, or effectiveness. Perceived hedonic value focuses on intrinsic motivation from interacting a system or technology as such.

DMB service, the objective of this research, provides not only audio and video but also various data through mobile devices. People can listen to English educational programs or watch a music video or check stock price while moving. So to speak, DMB serves both hedonic and utilitarian purposes. Individual can use DMB for entertaining or performing a task regardless of time and place. Therefore, we propose perceived hedonic value (PH) and perceived utilitarian value (PU) as key determinants of DMB adoption and hypothesized these factors have a positive influence on intention to service usage. Those hypotheses are consistent with prior studies. Davis et al. (1989) argued intention to IT usage may be affected by anticipated job performance regardless of overall attitude. In other words, even a user who dislikes a system uses it due to perceived usefulness in the side of job performance. Some researches (Sandelands et al., 1983; Webster et al., 1990) found user's positive attitude result from playful experience. In addition, Kat's study (1987) showed certain of high correlation between playfulness and users' positive attitude by a comparison analysis between microcomputer users and mainframe users.

One may regard emotional worth as usefulness. From this point of view, Heijden (2004) insisted "an intrinsically motivated user is derived by benefits derived from the interaction with the system per se." A user experiencing pleasure while using DMB can perceive the use of service itself to be useful. Thus, we develop a hypothesis in which perceived hedonic value has a positive influence on perceived utilitarian.

The assumption in which perceived control (PC) affects intention to use is reasonable. If a user does not have resources or ability to access and use the service— even so DMB services supply very useful and interesting information—one cannot decide to use it. This perceived control extends perceived behavior control in previous researches (Ajzen and Madden, 1986; Ajzen, 1991; Taylor and Todd, 1995). So to speak, the concept covers not

only perceived behavior control but also ease of use in TAM. According to Venkatesh and Davis's study (2000), the easier a technology is to use, the more useful it is perceived to be and the more positive attitude and intention there is to IT usage. In other words, ease of use has indirect influence on intention through perceived usefulness. Besides, Heijden (2004) verified ease of use has indirect influence on intention through perceived enjoyment. Based on those researches, hypotheses are developed as following.



<Figure 1> Research Model

- H1. PC will have a positive influence on PH.
- H2. PC will have a positive influence on IU.
- H3. PC will have a positive influence on PU.
- H4. PH will have a positive influence on PU.
- H5. PH will have a positive influence on IU.
- H6. PU will have a positive influence on IU.

### 3.2 Variables and Measurements

Perceived hedonic value refers to psychological rewards, the extent to which pleasure and gratification from using DMB service. Perceived utilitarian value is external benefits such as improving task performance. To measure the constructs, we have modified and used Heijden's instruments (2004) for PH and Venkatesh and Davis's instruments (2000) for PU.

Perceived control is comprehensively conceptualized by including the ease of use in TAM and perceived behavior control proposed by Taylor and Todd (1995): That is the perceived level of ability to use DMB without any monetary, technical, or environment obstacles.

A dependent variable in our model is intention to adopt of DMB. The goal of theories explaining technology acceptance is to predict whether one uses new system or technology or not. Because it has been verified there is a very strong correlation between behavior intention and actual behavior, we focus on intention to service acceptance and measure that by using instruments proposed by Venkatesh et al. (2003).



As variables can be seen from [Table 1], they present a potential user's whole perception where we do not consider specific functions of DMB.

[Table 1] Research Variables and Measurements

Research Variables	Measurements	
Perceived hedonic value	DMB service is enjoyable/disgusting. DMB service is exciting/dull. DMB service is pleasant/unpleasant. DMB service is interesting/boring.	PH1 PH2 PH3 PH4
Perceived utilitarian value	Using DMB service improves my performance in my job. Using DMB service in my job increases my productivity. Using DMB service enhances my effectiveness in my job. I find DMB service to be useful in my job. I find DMB service to be helpful in my job.	PU1 PU2 PU3 PU4 PU5
Perceived control	It is easy to learn how to use DMB service. I find DMB service to be easy to use. I have the sufficient ability to make use of DMB service. Using DMB service is entirely within my control. I have the resources and knowledge necessary to use DMB service.	PC1 PC2 PC3 PC4 PC5
Intention to use	I intent to use DMB service soon. I plan to use DMB service soon.	IU1 IU2

### 3.3 Data Collection

To examine the hypotheses developed in the previous section, we conducted a survey via e-mails and interviews from August 1 to September 10, 2005. The first page of the questionnaire presented the brief explanation of DMB channel provided TU Media which offered commercial service during survey days. Data was collected from teenagers to those in their sixties in five major cities in Korea: Seoul, Daejeon, Gwangju, Daegu, and Busan.

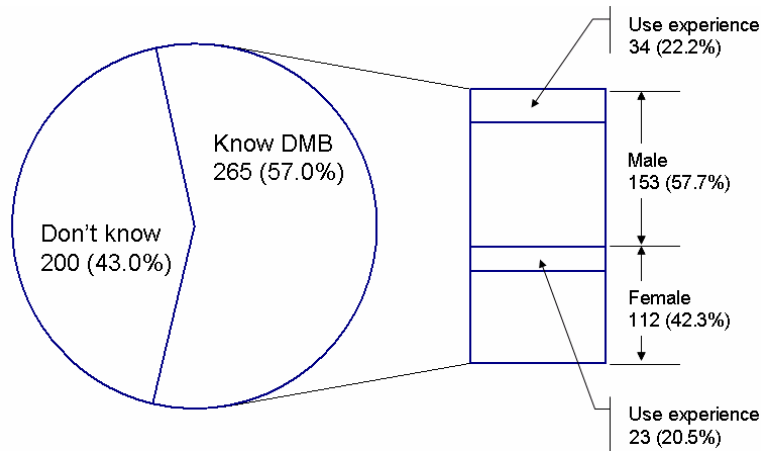
Among total 700 questionnaires, 513 were retrieved. Available 465 questionnaires among them were used for analysis. Respondents were consisted of 241 males (51.8%) and 224 females (48.2%) so that gender composition was comparatively balanced. Of respondents, the percentage of teenagers was 23.9%, those in their twenties 30.1%, those in their thirties 32.0%, those in their forties 7.7%, and those over fifties 6.2%. We did not focus on a particular age group by design, but the result is likely to reflect on the nature of study area and survey methodology. In other words, young respondents participated more willingly and positively in the survey and more significant data was secured from them.

[Table 2] Demographics

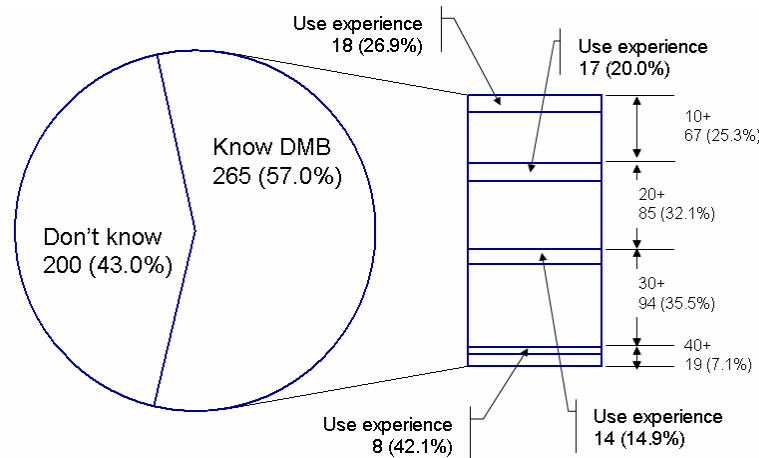
Variables		<i>n</i>	<i>%</i>
Gender	Male	241	51.8

	Female	224	48.2
Age (years)	10-19	111	23.9
	20-29	140	30.1
	30-39	149	32.0
	40+	65	14.0

Before testing hypotheses, we investigated overall perception of potential users and whether respondents use DMB or not. <Figure 2> shows the results.



a. By Gender



b. By Age

<Figure 2> Overall Perception of Potential Users and Service Usage Conditions

For a particular question which asked them what function they wanted to see on the cellular phone the most in the future, the respondents chose such entertaining functions as camera, MP3, and movie the most. However, only 6.7% selected DMB service in which .9% of male and 6.7% of female wanted to use DMB. This result indicates that female was more susceptible to DMB service than male. The younger a person may be, the stronger desire one has for using DMB (teenagers 8.5%, those in their twenties 6.4%, those in their thirties 6.1%, and those over forties 2.8%).

We confirm the potential user's perception on DMB service is very low. To revitalize related market, marketing strategies which can improve lower level of individual perception and bring DMB into relief should be ahead above all things. It matches the purpose of our study.

#### 4. Empirical Analysis

##### 4.1 Reliability and Validity

Reliability is evaluated with Cronbach's  $\alpha$ . The first analysis showed the coefficients can be improved if PH4 is deleted. Thus, we deleted the item and did a reanalysis with 15 items finally. [Table 3] represents all values exceeding the recommended value of .7 (Hair et al., 1998).

[Table 3] Reliability Analysis

	# of Initial item	# of final item	Final Cronbach's $\alpha$
Perceived hedonic value	4	4	.923
Perceived utilitarian value	5	5	.963
Perceived control	5	4	.884
Intention to use	2	2	.896

Construct validity was accessed by factor analysis. We applied Varimax rotation for 15 items except for PC4 which was deleted in prior reliability test. Factor loadings for all variables were greater than .5 and five factors were extracted (Refer to [Table 4]). The result supports convergent and discriminant validity. To verify it statistically, we performed confirmatory factor analysis by Amos 5. The purpose of this analysis is to delete factors hampering unidimensionality.

[Table 4] Factor Analysis

Variables		factor 1	factor 2	factor 3	factor 4
Perceived hedonic value	PH1	.833			
	PH2	.855			
	PH3	.809			
	PH4	.822			
Perceived utilitarian value	PU1		.829		
	PU2		.824		
	PU3		.823		
	PU4		.705		
	PU5		.573		
Perceived control	PC1			.833	
	PC2			.847	
	PC3			.819	
	PC5			.725	
Intention to use	IU1				.811
	IU2				.866
Eigen Value		3.689	3.565	3.165	1.946

Variance (%)	24.591	23.765	21.099	12.974
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First, we did for all exogenous variables (GFI = .903, AGFI = .866, RMR = .125, NFI = .945), then ran it again after deleting PC4 of which loading value was low consistently in the former analyses (GFI = .913, AGFI = .876, RMR = .121, NFI = .954). The goodness of second analysis was better so that we examined the hypotheses based on the second.

#### 4.2 Hypothesis Testing

To test proposed hypotheses, we analyzed correlation and structural equation model. All hypotheses were supported by correlation analysis (Refer to [Table 5]).

[Table 5] Correlation Matrix

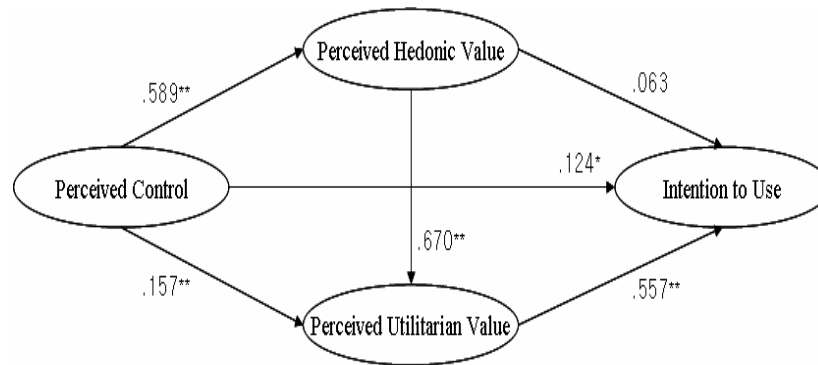
	Mean	Std. Dev.	PH	PU	PC	IU
PH	4.17	1.65	1.00			
PU	3.68	1.47	.74	1.00		
PC	4.39	1.58	.54	.55	1.00	
IU	3.21	1.62	.66	.54	.45	1.00

Note. All coefficients are significant at the level of  $p < .01$

Correlation analysis, however, cannot reflect interaction effect sufficiently between variables and cause information loss as summarizing multiple measurements into a single item as the mean. Even though the correlation coefficient is statistically significant, we cannot know the direction of effect between two constructs. In structural equation modeling, this is taken into account when the correlations among the latent variables are examined; hence their “true” correlation is reflected. This provides an added benefit in that the correlations among the measured variables are an indication of their reliability, and structural equation modeling can correct for this (Streiner, 2006). Consequently, a structural equation model considers effects of all variables and investigates causal relation, it is generally evaluated that the result from the model is more reliable than the result from correlation analysis. Thus, we analyzed a structural equation model using Amos to ensure reliability of this research and verified hypotheses.

We evaluated overall research model. The indexes of goodness are  $\chi^2 = 320.774$ ,  $df = 84$ ,  $RMSEA = .078$  ( $\leq .08$ ),  $NFI = .954$  ( $\geq .9$ ),  $CFI = .965$  ( $\geq .9$ ),  $GFI = .913$  ( $\geq .9$ ),  $AGFI = .83$  ( $\geq .8$ ) where they satisfy the criterion of goodness (The figures in parentheses are the accepted level of goodness-of-fit indices.).

Then, we inspected the result of hypotheses test. Referring to <Figure 3>, only Hypothesis 5, “perceived hedonic value will have a positive influence on intention” was rejected.



Note. \*\*. Significant at the level of  $p < .01$

\* . Significant at the level of  $p < .05$

<Figure 3> Structural Equation Model

Perceived control which refers to technical, monetary, and environmental conditions or ability affects not only directly but also indirectly on intention to DMB use through perceived hedonic and utilitarian values. That is, even though a service or a technology is perceived very useful, a potential user may hardly accept it if one does not have required resources or opportunities to use it. Especially, the standardized coefficient is comparatively high value, .589. We judge that a user may feel more interested in using the service when one perceives to have sufficient ability and to be satisfied with internal and external conditions for usage.

The hypothesis, where perceived hedonic value will have a positive influence on intention, was not accepted. It can be interpreted it is difficult to raise intention to use if service meets only users' pleasurable needs to compensate for effort and cost paid to learn or use DMB. However, we should not neglect the importance of inherent value such as fun or enjoyable nature of DMB because perceived hedonic value affects indirectly intention through perceived utilitarian value. Furthermore, the standardized coefficient between perceived hedonic value and utilitarian value is the highest, .670 so that we conclude the indirect effect of perceived hedonic value is more important than other factors proposed. Users can perceive it as useful and helpful if they use multimedia services for work or fun on the move indoor or outdoor.

DMB has mixed nature with both hedonic and utilitarian values. To raise efficiently intention of DMB usage, it is required to furnish enjoyable and useful contents and meet the internal and external conditions that can prompt actual usage.

Comparing the importance of perceived control and perceived utilitarian by coefficient value, the value of perceived utilitarian (.557) is higher than perceived control (.124). DMB services are offered via already popular and widely used mobile devices including cellular phones, PDAs, notebooks, and navigators. Thus, potential users can perceive there are not many difficulties for DMB usage.

## 5. Conclusion

The advance of digital technologies brings up convergence of telecommunication, broadcasting, and computer industry. As the boundaries among those channels become

more ambiguous, the competition among them becomes more intense to win over customers.

Existing perspective on convergence of telecommunication and broadcasting had focused on technical approaches to supply commercial service or regulation to control the market. To attain maturity of market rapidly, however, it is a matter of importance to clarify the factors which can promote users' adoption directly or indirectly. Thus, this paper proposes determinants of users' intention for DMB, a new and representative service appeared in convergence environment of telecommunication and broadcasting.

We assumed hedonic and utilitarian values were deeply and cognitively associated with potential users' intention toward DMB based on technology acceptance models and motivation theory. Furthermore, we proposed perceived control as internal and external conditions for IT usage.

Our research model was verified by an empirical test. Only Hypothesis 5 in which perceived control would have a positive influence on the intention to DMB usage was rejected. Then, the analysis and discussion led us to the following conclusions:

First, the perceived control has not only indirect but also direct impact on intention to use through perceived hedonic and utilitarian values. Second, even though the perceived hedonic value does not show a significant impact on the use intention, it has a positive influence on the dependent variable indirectly through the perceived utilitarian.

To have relative advantages over existing media and create unique benefits as an efficient business model, it is required to break from rebroadcasting entertainment programs of terrestrial broadcasting. Enterprises should develop and offer contents containing useful information matching each user's context (time, place, and individual information, and so on) correctly with interesting format by making the best use of the merits of mobile environment. Especially, considering that DMB is offered through personal devices in contrast with other media, service providers should develop competitive power of personal and portable broadcasting constructively by customizing contents to individual lifestyles.

Since services in convergence of telecommunication and broadcasting do not have identical characteristics (e.g., DMB vs. IP-TV, portable DMB vs. embedded DMB), we did not consider the nature of DMB systems. Nevertheless, further researches are necessary to investigate the specific characteristics of relevant services without damaging the parsimony and generality of the research model. The extraction of relevance research variables and verification can be more easily performed with creation and diffusion of convergence services consistently and diversely.

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