

Predictors of Digital Information Technology Adoption: A Case of Digital Terrestrial Television (DTT) Adoption in South Korea

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Abstract: This study investigated factors affecting adoption intention of direct Digital Terrestrial Television (DTT) assuming that predictors affecting the adoption intention of DTT are differentiated based on free of charge and with willingness to pay. Researches showed that predictors affecting DTT adoption with willingness to pay were differentiated from those of DTT adoption free of charge. In particular, innovative character did not predict adoption intention of DTT free of charge whereas innovative character was shown to be a powerful predictor in adopting DTT with willingness to pay. Implications and limitations are also discussed.

Key words: Digital technology, Digital Terrestrial Television (DTT), digital broadcasting, limitation, diffusion of innovation, TAM, logistic regression analysis

INTRODUCTION

Presently, the established analogue media has converted to the digital format and most emerging broadcasting services are on the basis of digital technology. For this reason, most countries worldwide are rushing to switch off analogue and switch over in order to switch over to digital as quickly as they can. For example, Finland and Sweden first completed the transition in 2007 followed by Switzerland and Germany in 2008 and The United States, Denmark and Norway in 2009. The rest of the world plans to switch over during the 2010-2016 period (<http://www.digitag.org/ASO/ASO.html>). In particular many Asian countries except for, Vietnam (Vietnam yet has no further plan for digital transition even though Vietnam established a DVB Channel in 2010) are executing the switchover progress slowly, e.g., Taiwan will shut down its analogue television system by 2012 and China, Malaysia, Thailand and the Philippines will terminate all analogue transmissions by the mid or end of 2015. The latest country, Singapore has a plan to complete digital transition keeping the step with other ASEAN countries between 2015 and 2020.

Likewise, the process of digital convergence in South Korea has also been slower than expected. There might be many reasons for the countrys sluggish progress in this regard; these include the controversy over how to transmit digital terrestrial television, the conflict of a policy planning between the Ministry of Information and Communication and the Korean Broadcasting Commission institutional inertia related to digital conversion the

support shortage for the replacement cost and the lack of publicity pertaining to the analogue switch off and digital switchover.

Although, the switchover to digital brought about a substantial agreement in 2012 to achieve the goal of switching off the analogue frequency by that time still face some very real obstacles. First of all as for digital device, the number of digital televisions supplied as of April, 2008 comes to 6.93 million according to the Korea Communication Commission's report published in 2009. This figure shows that the digital television penetration rate had reached 37.2% by that date in as much as Korea's households total 18 millions. Yet, the greater part of the penetration rate is more likely to be accounted for by the acquisition of digital televisions by companies, public institutions, restaurants, shops and other public places rather than by households. Next, public awareness of the switchover to digital and the analogue switch off of terrestrial television though has been slowly rising from 23% in 2005 to 31.1% in 2007 and to 48.1% in 2009. However, despite the fact that public awareness gets increased the latest figure showed that >50% of the general public still does not know that a switch over to digital is planned nor the date on which the analogue switch off is set to occur which shopws lower level of awareness when compared with the level of awareness in Japan and the UK both of which plan to implement switch overs in the same period as does South Korea awareness is 89% in Japan and 93.9% in the UK (Korea Communications Commission, 2009).

As is known well in order for a successful completion of switchover besides political support and public

relations efforts, it is necessary to increase public awareness of the DTV transition and to ensure that an adequate DTV supply is available as well. For this, the role of government is expected to be crucial in implementing digital transition because digital switchover policy is regarded as such compulsory that government should be highly involved in pushing up the completion of digital transition even though the path to digital switchover will be differentiated based on such factors as the digital terrestrial industry, the nature of media ownership, geographic uniqueness and other infrastructures (Guo, 2008). Detail analysis of factors predicting digital device purchase and adoption is also required.

Yet, a handful of analyses have been conducted on factors affecting the adoption of digital devices that support the terrestrial digital broadcasting transition. Given the fact that digital transition is based on the compulsory policy, researchers hypothesize that DTT adoption is rather different from other new media adoption, e.g., You *et al.* (2010) argued that factors predicting the adoption of DTV (device) and direct DTT (service) were found to be differentiated, i.e., DTT adoption without payment was heavily associated by such factors as awareness and attitude of digital transition as well as satisfaction with analog broadcasting service while DTV adoption was affected by innovative character such as perceived usefulness and ease of use.

Furthermore, the researchers pay attention to direct adoption of DTT which means using DTT service not by subscription TV but by direct receiver in that a large number of population in Korea currently use terrestrial broadcasting with direct receiver or antenna (Kang *et al.*, 2008). Additionally, researchers assume that the extent to which the public is willing to pay will affect to decide the adoption intention of DTT. It is necessary to pay attention to the extent of users payments intention for DTT because DTT service is based on the policy of universal service. Actually, previous studies pointed out the extent to cost that consumer need to pay was influential on deciding adoption of the digital television device or service (Lee and Kim, 2007; Kim and Kim, 2002; Joo, 2004). Thus, looking at the switchover on the basis of 2 distinct conditions free adoption and pay adoption the current study analyzes the effects of factors on DTT adoption intention which would be one of the core issues in digital switchover.

Literature review

Contributions from TAM and diffusion of innovation theory: By combining technology acceptance model with diffusion of innovation theory, the present study aims at

verifying the impact of different determinants on behavioral intention in the adoption of DTT service. For instance, the researchers expect that concepts suggested in diffusion of innovation theory (e.g., compatibility) can increase the understanding of DTT adoption. Actually by integrating TAM and diffusion of innovation theory (Lopez-Nicolas *et al.*, 2008), TAM studies have been theoretically extended for explaining adoption intention in terms of social influence and cognitive instrumental process besides perceived usefulness and ease of use (Venkatesh and Davis, 2000; Venkatesh and Bala, 2008). Lopez-Nicolas *et al.* (2008) addressed diffusion related variables such as perceived benefits and social influence could be associated with perceived usefulness and ease of use and thus their research contributed to the emerging body of research by integrating TAM with diffusion of innovation theory.

Perceived usefulness, perceived ease of use and cost benefit: TAM derives from the Theory of Reasoned Action (TRA) and the Theory of Planned Behavior (TPB) according to TRA a persons behavior is determined by his/her intention to perform the behavior and that this intention is in turn a function of the persons attitude and subjective norms regarding the behavior (Fishbein and Ajzen, 1975). The TPB Model is on the basis of the premise that humans are rational and that their behaviors are under volitional control (Fishbein and Middlestadt, 1997). On the one hand, the TPB Model extends the TRA Model by incorporating an additional construct namely perceived behavioral control in order to account for situations in which an individual lacks substantial control over a targeted behavior (Ajzen, 1991).

Specifically, TAM theorizes that an individuals behavioral intention to use a system is determined by that two beliefs that the person holds (Venkatesh and Davis, 2000); perceived usefulness defined as the degree to which a person believes that using a particular system would enhance his or her job performance (Davis, 1989; Davis *et al.*, 1989) and the perceived ease of use whereby the person thinks that using a particular system would be free of effort (Davis, 1989). Furthermore, TAM consistently explains a substantial proportion of the variance (typically about 40%) between usage intentions and behavior. It also compares favorably with the alternative models TRA and TPB as noted earlier (Venkatesh and Davis, 2000). Meanwhile, the concepts of perceived usefulness and ease of use are associated with the concepts of relative advantage and complexity in diffusion of innovation theory. As an illustration complexity defined as the degree to which an innovation is perceived as relatively difficult to understand and use (Everett, 1971), parallels perceived ease of use quite closely (Davis, 1989). Therefore, researchers included

perceived usefulness and ease of use referring to many TAM studies (Adams *et al.*, 1992; Chau, 1996; Van der Heijden, 2003; Hsu and Lin, 2008; Lin, 2003; Saade and Bahli, 2005; Shin, 2009b).

Further, the present study adds a cost benefit as a significant factor in deciding to use DTT considering that individuals use to compare the expected benefit from the service with the cost for using the service. In some extended TAM studies cost variables are widely studied as one of the significant factor in decisions to adopt new media (Teo *et al.*, 2004; Wu and Wang, 2005). These studies suggest that the extent to which users are willing to pay for new media could significantly affect the adoption and diffusion of digital television and related services. For instance, Lee and Kim (2007) investigated factors affecting users adoption of internet protocol TV and found not only that users confidence and innovative attitude acted on perceived ease of use but also that subjective norm and cost benefit influenced on perceived usefulness. Kim and Kim (2002) found that potential HDTV users expressed a lower adoption intention than did early HDTV adopters when the potential user were less willing to pay or felt the cost was too high. Joo (2004) also investigated the possibility that users regard price as a crucial factor in deciding whether they use DTV or not and found that users who are willing to pay for digital broadcasting tend to positively consider the adoption of DTV. However, Shin (2009a) showed a contradictory finding that cost level did not affect the intention of IPTV use. Paying attention to these conflict results from previous studies the present study included a cost variable in the research model to verify the explanatory power of a cost variable. Thus, the researchers hypothesize that:

- H₁: Innovative characters (perceived usefulness, ease of use and cost benefit) will affect users adoption intention of DTT service
- H_{1a}: Innovative characters will be differently found between intender and non-intender of DTT adoption
- H_{2b}: Innovative characters will have a different effect on pay adoption intender and free adoption intender

Audience evaluation from diffusion of innovation theory:

Not a few studies have attempted to identify the variables that affect the adoption and diffusion of new media and technology (Atkin *et al.*, 1998, 2003; Dickerson and Gentry, 1983; Lin, 1998, 2001, 2003; Lin and Jeffries, 1998). These studies generally identified user adoption of media as one of the critical factors. Furthermore, the innovative characters of audiences and their perceptions toward new media the traits of the users themselves and the socio institutional force have been examined as the various variables impacting on adoption of new media. In that

regard, Rogers's diffusion theory has been considered as a useful framework to predict adoption intention of new media and technologies. Dupagne (2002) also points out that diffusion is an appropriate framework for studying DTV adoption.

Rogers (2003) argues that certain characteristics inhering innovation have effects on the degree of users adoption behavior and thinking in deciding new technology usage. These characteristics are classified into 5 factors; relative advantage, compatibility, complexity, trialability and observability. Rogers defined relative advantage as the degree to which an innovation is perceived as being better than the idea it supersedes, compatibility as the degree to which an innovation is perceived as being consistent with the existing values, past experiences and needs of the adopters, complexity as the degree to which an innovation is perceived as relatively difficult to understand and use, trialability as the degree to which an innovation may be experimented with on a limited basis and observability as the degree to which the results of an innovation are visible to others. The 5 characteristics of the diffusion of innovations have been attested in many studies, e.g., Tornatzky and Klein (1982) employed meta analytic statistical techniques to assess the generality and consistency of existing empirical findings and 25 characteristics of innovation and concluded that compatibility relative advantage and complexity had the most consistent significant relationships with innovation adoption. Williams *et al.* (1994) also indicated that diffusion theory could systematically explain how users communicate, evaluate, adopt and reevaluate new technology within the framework of demand.

As for one of the audience factors, the researchers highlighted that compatibility of the 5 characters could be crucial in adopting DTT service because DTT service is closer to extend the analog broadcasting service rather than a purely new established one. The compatibility is also associated with the notion of information quality (DeLone and McLean, 1992). By referring to this, Beyah *et al.* (2003) suggested perceived content quality and indicated that perceived content quality was significant predictor in using an information system. Thus, from the necessity of looking into the effect of past experience and existing value from the use of analog broadcasting service on adoption intention of DTT service, the current study included audience satisfaction for analog television in research model.

Furthermore, the researchers assumed that the extent to which potential users are aware of an innovation and their view of it could be critical in individuals' intention to use the services and applications which might be a key

aspect of diffusion theory (Rogers, 2003). In addition, Ostlund (1974) noted that the attitude of users toward a given innovation is the most important factor in the degree of diffusion underlining the point that the higher the potential users interest in and use of innovation in general, the more likely they are to adopt a given innovation. Not a few researches on user variables have focused on identifying those variables (Chan-Olmsted and Chang, 2006; Everett, 1971). These studies identified various variables as attitude toward or recognition of the innovation such as self efficacy self confidence life satisfaction spirit of adventure and so forth. However, when considering that DTT service is established by compulsory policy, individuals awareness and needs for this service among various attitudes and recognition are more crucial factors in predicting users adoption intention of DTT service rather than other attitudes or recognitions (Dupagne, 2006). Thus, the researchers added awareness and needs for DTT service in the research model. Therefore, researchers expect that:

- H₂: Audience evaluations (awareness, needs and satisfaction with analog broadcasting service) will affect users adoption intention of DTT service
- H_{2a}: Audience evaluations will be differently found between intender and non intender of DTT adoption
- H_{2b}: Audience evaluation variables will have a different effect on pay adoption intender and free adoption intender

Demographic properties: According to Rogers (1986), the socioeconomic status of a user determined by aspects such as income, job and education is a critical factor in determining the adoption of a new media service. In fact in accord with Rogers's study, many relevant studies have reported that demographic factors are significantly associated with the adoption intention of new media and technology including personal computer, video cassette recorders, satellite broadcasting, mobile TV and IPTV (Danko and MacLachlan, 1983; Dupagne, 1999, 2006; Litman *et al.*, 1991; Reagan *et al.*, 1985). For example, Park (2004) studied that early adopters of satellite broadcasting found that the higher education and socioeconomic status early adopters are at the higher innovative characteristics they have. In addition, Lee (2003) indicated that income and education have an influence on the adoption of digital broadcasting. These studies suggest that demographic factors could be important variables in the rate at which new media is taken up by users. Yet, some studies suggested contradictory findings that demographic factors have little influence on the adoption of new media and no correlation between demographics

and adoption of new media was already reported by previous studies (Jeffres and Atkin, 1996; Rogers, 2002). For instance, Kang *et al.* (2002) found that demographic factors of early adopters of digital cable did not seriously affect the adoption of digital cable. Also, Joo (2004) noted that some demographic factors such as sex, age and income were not significant variables affecting the adoption of digital TV.

Even though, the results on this point were shown to be contradictory the present study assume that it is necessary to verify the effect of demographics on DTT adoption because DTT policy actually considers demographic determinants such as age, education and residential area and mode of reception as crucial factors (Kang *et al.*, 2008). Therefore, the study hypothesize that:

- H₃: Demographic properties will affect user's adoption intention of DTT service
- H_{3a}: There will be demographic difference of DTT adoption intention between intender and non intender
- H_{3b}: There will be demographic difference of adoption intention between pay adoption intention and free adoption intention

In sum, the current study aimed at predicting factors that affect the adoption intent of DTT service. Specifically, researchers explored whether or not the factors in adopting DTT service were differently found between the intender and the non intender and between free adoption intention and pay adoption intention. Also, researchers investigated how these factors are differently influential on adopting DTT service in the case of free adoption intention and pay adoption intention.

MATERIALS AND METHODS

Data: This study used national survey data of South Korea in 2008 which was conducted by Digital Television Korea (DTV Korea), the Korea Radio Promotion Agency (KORPA) and 4 major terrestrial television companies (KBS, MBC, SBS, EBS). In this data, collected November 16 to December 16, 2008, about 2500 households were randomly selected using a quota sampling method based on age, gender, region and type of residence.

As shown in Table 1, the data was collected from a sample that was 40.6% male and 59.4% female of whom 6.9% were in their 20's, 14.3% in their 30's, 18.7% in their 40's, 20.9% in their 50's and 39.2% in their 60's. Regionally 41.1% lived in the capital city 18.0% lived in middle sized cities and 40.9% lived in small cities.

Table 1: Demographic character of data

	Region			Gender		Age				
	Capital	Mid size city	Small city	Male	Female	20(s)	30(s)	40(s)	50(s)	Over 60(s)
Number	1027	451	1022	1016	1484	173	357	468	523	979
Percent (%)	41.1	18.0	40.9	40.6	59.4	6.9	14.3	18.7	20.9	39.2

Measures

Demographics: Variables such as age, income and education were considered as were region type of residence and type of terrestrial television currently used. Of demographic variables, residential type and mode of reception are categorical variables. Residential type consisted of single residence (town house), co-residence (small condominium) and apartment assuming that the use of DTT service could be affected by residential type (e.g., monthly rental fee may include subscription TV charge in many apartments).

As for mode of reception, researchers asked how participants currently watch terrestrial broadcasting direct reception with receiver subscription TV, satellite TV or others. Mode of reception was recoded as dichotomous answer (0 = Direct, 1 = Indirect).

Innovative characteristics: In order to assess perceived usefulness, participants answered 4 Likert scale survey questions (ranging from 1 = Not at all to 5 = Extremely) adopted from Davis (1989) study including; I would find digital terrestrial broadcasting useful in my life; using digital terrestrial broadcasting would enable me to get easily connected with digital life, using digital terrestrial broadcasting would improve my digital life without spending much money and/or time and using digital terrestrial broadcasting would increase the quality of my life (Cronbachs alpha = 0.71). And 2 items were used to measure perceived ease of use including; learning how to use digital broadcasting would be easy for me and I would find digital broadcasting ease to use (r = 0.64).

Further, in order for assessing cost benefit variable respondents answered 2 Likert scale survey questions (ranging from 1 = Not at all to 5 = Extremely) adopted from previous studies (Kim and Kim, 2002; Lee and Kim, 2007; Shin, 2009a, b; Wu and Wang, 2005) including; I think it is worthy of payment to use digital broadcasting service by purchasing a digital receiver (or antenna) and digital broadcasting is expected to give me economic benefit (r = 0.39). Therefore, the current study identified innovation characteristics in terms of three factors perceived usefulness perceived ease of use and cost benefit.

Audience evaluation: This factor consisted of three sub-factors: awareness about the DTT transition, needs for DTT adoption and satisfaction with both content and

clarity of analog television. First awareness, You *et al.* (2010) operationalized awareness as knowledge participants had about the DTT service. By referring to this, awareness was assessed by asking respondents to agree or disagree with seven questions whereby they indicated they knew basic facts about the DTT transition including: I know that the due date of analog television switch off in 2012; I know that an antenna is necessary to directly adopt terrestrial digital television; I know that I need a digital device to adopt terrestrial digital television; I know that I should set up an antenna for directly receiving terrestrial digital television I know that there is a different place to set up an antenna depending on residential type; I know that I can watch pay TV without additional work after the analog television switch off; I know that I need to check the Master Antenna (MA) or outdoor antenna if I would like to directly adopt terrestrial digital television.

The total score of the correct answers (ranging from 0-7) was used. Next, 2 Likert scale survey questions (ranging from 1 = Not at all to 5 = Extremely) regarding how much respondents considered DTT transition was used to assess needs adopted by the previous study (You *et al.*, 2010) including it is necessary to use digital terrestrial broadcasting services after digital switchover and it will be beneficial if i use digital terrestrial broadcasting services after digital switchover (r = 0.36). Lastly, satisfaction with content and clarity of analog television were assessed each from two items: I am satisfied with television content offered in analog broadcasting and I am satisfied with clarity while watching analog broadcasting. Each item was measured on 5 point scale.

Dependent variable: As noted, the current study distinguished free adoption intention of DTT from pay adoption intention of DTT. The extent of users payments intention for DTT was announced as no exceeding the extent of current payment for subscribing cable TV or satellite TV. Two items were used to identify a dependent variable. An item (0 = No; 1 = Yes) of; I will use DTT service with receiver or converter for free was used to measure for free adoption intention of DTT service while the other item (0 = No, 1 = Yes) of; I am willing to pay for using DTT service insofar as cost does not exceed subscription broadcasting service was used to assess pay adoption intention of DTT service.

Statistical method: Researchers first conducted a t-test in order to verify the mean difference of each factor between intender and non intender for H_{1a} - H_{3a} . For region type of residence and mode of reception of demographic properties, researchers conducted a χ^2 -test because these factors were measured on a nominal scale. For H_{1b} - H_{3b} , researchers adopted a hierarchical multiple logistic regression analysis in order to look at each factors relative effect at the each step.

RESULTS

Differences between intenders and non-intenders in adopting DTT: Firstly as to demographics, researchers examined a difference between intender and non-intender of cost free adoption. A difference by age, income and education was not found whereas a difference by region a mode of reception and residential type was found. In case of region, the rate of intender in capital was higher than in middle size cities and it was shown that there was a relatively high difference between intender (47.0%) and non-intender (11.7%) in small cities (Pearson $\chi^2 = 32.17$; $p < 0.001$). A difference was also shown according to a mode of reception. That is directly receiving household was relatively more likely to directly adopt than indirectly receiving household (Pearson $\chi^2 = 12.73$, $p < 0.001$). Further, in terms of residential type the relatively higher intention to directly adopt terrestrial digital television for townhouse residents (37.3%) was found than other 2 residential types (Pearson $\chi^2 = 16.49$, $p < 0.001$) (Table 2).

Secondly, a difference between intenders and non-intenders by innovative characteristics such as usefulness ease of use and cost benefit was found for both cost free adoption and willingness to pay adoption. The interesting point was that in both cases no difference was found in terms of ease of use even though there was a difference in terms of usefulness and cost benefit. Specifically, those likely to directly adopt DTT both with and without payment show higher usefulness ($t = 2.74$, $p < 0.01$) and cost benefit ($t = 4.37$; $p < 0.001$). However in both cases, there was no difference between intenders and non intenders in terms of ease of use.

Thirdly, researchers did find a difference between intender and non-intender by the audience factors of awareness, needs and satisfaction. Among these factors, awareness showed a huge difference between the 2 groups.

In addition, the result showed a difference between intenders and non-intenders by both factors of satisfaction with content and clarity in the case of cost free adoption intention ($t = -2.56$, $p < 0.05$; $t = -2.43$; $p < 0.05$). However, researchers could not find any difference in the case of intention to directly adopt DTT with willingness to pay (Table 2).

It should be noted that as a follow up study, the present study replicated the result from the study of You *et al.* (2010) using the same data set in this part (In Table 3 and as partly Table 1) in order to exactly compare the predictors of DTT adoption free of charge with these of DTT adoption with willingness to pay.

Table 2: Differences in direct DTT adoption with/without paying between intenders and non-intenders

Factors	Intention of adoption without paying			Intention of adoption with willingness to pay		
	Intender (n = 1775)	Non-intender (n = 725)	T	Intender (n = 1603)	Non-intender (n = 897)	T
Demo graphics						
Age	53.63	52.59	1.52	52.66	54.53	-2.93**
Income	2.70	2.77	-1.23	2.78	2.61	3.49**
Education	1.92	1.94	-0.58	1.97	1.85	3.87***
Region (I)						
capital	10.6%	6.7%	32.17***	10.4%	6.8%	14.72***
Mid size city	16.0%	7.4%	-	13.8%	9.6%	-
Small city	44.4%	15.0%	-	39.9%	19.5%	-
Residential type:						
Apartment	18.4%	7.8%	16.49***	17.4%	8.9%	3.01
Co-residence	15.3%	8.2%	-	14.4%	9.0%	-
Townhouse	37.3%	13.0%	-	32.3%	18.0%	-
Mode of reception:						
Direct adoption	7.8%	1.8%	12.73***	6.3%	3.3%	0.24
Indirect adoption	63.2%	27.2%	-	57.8%	32.6%	-
Innovative factor						
Usefulness	0.035	-0.086	2.74**	0.109	-0.195	7.23***
Ease of use	-0.002	0.005	-0.15	-0.024	0.044	1.64
Cost-benefit	0.056	-0.136	4.37***	0.108	-0.192	7.26***
Audience factor						
Knowledge	2.16	1.680	6.39***	2.20	1.70	6.75***
Needs	4.00	3.570	15.82***	4.02	3.62	15.62***
Satisfaction with content	3.41	3.500	-2.56*	3.43	3.46	-0.97
Satisfaction with clarity	3.66	3.740	-2.43*	3.67	3.70	-1.28

Region, residential type and mode of reception were written as percentage instead of frequency after conducting crosstab analysis; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 3: Factors affecting the intention to adopt direct DTT without payment

Factors	Model 1			Model 2			Model 3		
	B (SE)	Wald	Exp (B)	B (SE)	Wald	Exp (B)	B (SE)	Wald	Exp (B)
Intercept	0.311	0.595	1.365	0.349	0.738	1.418	-4.937	71.108	0.007
Demo-graphics									
Age	0.005	2.104	1.005	0.007	3.030	1.007	0.008	3.761 [#]	1.008
Income	0.005	0.010	0.995	-.011	0.057	0.989	0.029	0.348	0.971
Education	0.170	4.212 [*]	1.186	0.156	3.446	1.169	0.119	1.771	1.127
Region:									
Mid-sized city	0.396	8.209 ^{**}	1.486	0.338	5.587 [*]	1.402	0.579	14.022 ^{***}	1.785
Small city	0.643	26.774 ^{***}	1.903	0.593	21.975 ^{***}	1.809	0.720	28.179 ^{***}	2.054
Residential type:									
Co-residence	0.041	0.102	0.960	-0.006	0.002	0.994	0.095	0.483	1.100
Town house	0.255	4.911 [*]	1.291	0.295	6.458 [*]	1.343	0.317	6.661 [*]	1.373
Mode of reception	0.654	13.686 ^{***}	0.520	-.689	15.096 ^{***}	0.502	0.697	13.520 ^{***}	0.498
Innovative factor									
Usefulness	-	-	-	0.138	8.598 ^{**}	1.148	0.073	2.102	1.076
Ease of use	-	-	-	0.003	0.003	1.003	0.032	0.406	1.033
cost-benefit	-	-	-	0.196	18.673 ^{***}	1.216	0.091	3.390	1.095
Audience factor									
Awareness	-	-	-	-	-	-	0.121	15.972 ^{***}	1.129
Needs	-	-	-	-	-	-	1.131	178.241 ^{***}	3.098
Satisfaction with content	-	-	-	-	-	-	0.200	6.672 [*]	1.221
Satisfaction with clarity	-	-	-	-	-	-	0.071	0.810	1.074
-2-Log likelihood	2952.27	-	-	2924.81	-	-	2669.15	-	-
χ^2_{12} , χ^2_{22}	58.49 ^{***}	-	-	27.46 ^{***}	-	-	255.66 ^{***}	-	-
	58.49 ^{***}	-	-	85.95 ^{***}	-	-	341.61 ^{***}	-	-
df ₁ , df ₂	8, 8	-	-	3, 11	-	-	4, 15	-	-
Nagelkerke R2	0.033	-	-	0.048	-	-	0.182	-	-

Region, residential type and mode of reception are categorical variables for each of which the criteria are capital, apartment and direct adoption 2: χ^2_{12} (df₁) refers to the model coefficient at each step; χ^2_{22} (df₂) refers to the total model coefficient; [#]<0.10, ^{*}<0.05, ^{**}<0.01, ^{***}<0.001

Effect on the DTT adoption intention

Factors affecting the DTT adoption intention with free of charge: Researchers conducted a hierarchical logistic regression analysis in order to investigate which factor or factors enhance this intention. The fitness of regression model was statistically significant at each step.

Firstly of the demographic factors, only region was found to be a significant factor. Meanwhile, the education factor lost its explanatory power as soon as an innovative characteristic was added. Also, those who indirectly adopt terrestrial analogue television were 49.2% less likely to directly adopt DTT than those who directly adopt terrestrial analogue television (B = -0.697; Exp (-0.697) = 0.498). Further, those living in small cities were 105% and those living in mid sized cities were 78% more likely to directly adopt DTT than were those who lived in the capital dweller. However, none of the innovative characteristic factors affected the intention to adopt DTT (Table 3).

Secondly, this study showed that most audience factors affected the intention to adopt direct DTT. In particular, needs was the most powerful factor for predicting the intention to adopt direct DTT free of charge showing that the odds of adopting direct DTT 210% increased as one unit of the needs increased (B = 1.131, Exp (1.131) = 3.098). Also, the odds 13% increased as one unit of awareness increased (B = 0.121, Exp (0.121) = 1.129). In addition, of the two satisfactions only

content satisfaction significantly affected the intention to adopt direct DTT. That is the odds that users would intend a direct DTT adoption free of charge was 22% increased as one unit of the satisfaction with existing broadcasting content increased. This can be explained by the fact that the users who were most satisfied with the existing content were the most loyal to it.

Factors affecting the DTT adoption intention with willingness to pay:

For the intention to directly adopt DTT with willingness to pay, the current study also conducted a hierarchical logistic regression analysis in the same way as researchers did for cost free adoption. It was found that the model at each step was statistically significant (Table 4).

Firstly among the demographic factors, only region was a significant predictor. Specifically, small city residents were 52% more likely to adopt direct DTT with payment than were capital city residents (B = 0.419, Exp (0.419) = 1.520). Education, similar to the adoption intention free of charge lost its explanatory power right after the audience factor was inserted. This result revealed that overall the demographic factors insignificantly affected the intention to adopt direct DTT with willingness to pay.

Secondly all the innovative characteristics, usefulness, ease of use and cost benefit significantly affected the intention with payment. That is the odds of

Table 4: Factors affecting the intention to adopt direct DTT with willingness to pay

Factors	Model 1			Model 2			Model 3		
	B (SE)	Wald	Exp (B)	B (SE)	Wald	Exp (B)	B (SE)	Wald	Exp (B)
Intercept	0.132	0.121	0.877	0.009	0.000	0.991	04.310	60.962	0.013
Demo-graphics									
Age	0.002	0.216	0.998	0.001	0.035	0.999	0.000	0.004	1.000
Income	0.081	3.259	1.084	0.074	2.664	1.077	0.064	1.780	1.066
Education	0.201	6.548*	1.223	0.197	5.886*	1.217	0.167	3.841	1.182
Region:									
Mid-size city	0.032	0.057	1.033	0.150	1.123	0.861	0.011	0.005	0.989
Small city	0.427	12.325***	1.532	0.329	6.826**	1.389	0.419	10.055**	1.520
Residential type:									
Co-residence	0.118	0.911	0.889	0.035	0.078	0.965	0.057	0.181	1.058
Town house	0.008	0.005	1.008	0.094	0.703	1.098	0.091	0.606	1.095
Mode of reception	0.036	0.061	0.964	0.129	0.721	0.879	0.068	0.176	0.934
Innovative factor									
Usefulness	-	-	-	0.316	46.876***	1.372	0.275	31.937***	1.316
Ease of use	-	-	-	0.128	7.959	0.880	0.131	7.287	0.877
Cost-benefit	-	-	-	0.304	47.205***	1.355	0.228	23.088***	1.256
Audience factor									
Awareness	-	-	-	-	-	-	0.123	18.994***	1.131
Needs	-	-	-	-	-	-	0.950	144.711***	2.587
Satisfaction with content	-	-	-	-	-	-	0.050	0.480	1.051
Satisfaction with content	-	-	-	-	-	-	0.084	1.308	1.088
2-Log likelihood	3220.25	-	-	3113.98	-	-	2906.55	-	-
χ^2_{12} , χ^2_{22}	43.37***	-	-	106.27***	-	-	207.43***	-	-
	43.37***	-	-	149.64***	-	-	357.07***	-	-
df _i , df _e	8, 8	-	-	3, 11	-	-	4, 15	-	-
Nagelkerke R2	0.024	-	-	0.080	-	-	0.183	-	-

Region, residential type and mode of reception are categorical variables for which each of which the criteria are capital, apartment and direct adoption χ^2_{12} (df_i) refers to the model coefficient at each step; χ^2_{22} (df_e) refers to the total model coefficient; * <0.10 , ** <0.05 , *** <0.01 , **** <0.001

the intention to directly adopt DTT with payment increased to 32% as one unit of the usefulness increased (B = 0.275, Exp (0.275) = 1.316). Also, the odds of this intention increased to 26% as one unit of the cost benefit increased (B = 0.228, Exp (0.228) = 1.256). However, ease of use was not a significant predictor in this case. This means that unlike decision making inhering in the adoption of other innovations people are not very interested in ease of use when considering adopting this particular innovation.

Thirdly of the audience factors, awareness and needs were significant and powerful predictors. That is the odds of the intention to adopt direct DTT with payment increased to 13% as one unit of awareness increased (B = 0.123, Exp (0.123) = 1.131) and the odds of intention to directly adopt DTT with payment increased to about 59% as one unit of the needs increased (B = 0.950, Exp (0.950) = 2.587). Meanwhile, mode of reception and satisfaction with content/clarity did not affect this intention unlike the case of the intention to directly adopt DTT without payment.

DISCUSSION

This study investigated the factors that affect potential users intentions to adopt DTT service and

whether or not adoption of this service would be governed by different factors in each case of pay adoption intent and free adoption intent. In summary, the findings showed that factors that influence on adoption intention were differentiated based on willingness to pay. Specifically as to differences between intenders and non intenders the findings showed that the intention to adopt DTT was not related to demographic factors such as age, income and education while the factors that can affect the broadcasting signal adoption such as region residential type and mode of residence were significantly related to the intention to adopt direct DTT. This means that geographic and spatial environment is highly associated with the intention of adopting direct DTT.

Further, a difference between intender and non-intender by some demographic factors such as age, income, education and region was found. This means that the intenders are younger (t = -2.93, p<0.01) have higher incomes (t = 3.49, p<0.01) and higher education levels (t = 3.87, p<0.001) than do non intenders. This result is similar to the results of previous research which showed that younger high income and highly educated people are more likely to adopt innovations than are older low income and less educated people (Danko and MacLachlan, 1983; Dupagne, 1999; Reagan *et al.*, 1985). However, unlike the case of cost free adoption any

difference between intenders and non intenders in the case of willingness to pay was found in terms of residential type and mode of reception.

In addition as to the factors affecting the intention to adopt direct DTT free of charge, the results showed that needs was the most powerful factor and the effect size of these factors was shown as region mode of reception residential type and satisfaction with content in order. Interestingly, even though innovative factors had been effective in Model 2 (Table 3), they lost their explanatory power as soon as audience factors were added. However contrary to the expectation, the result indicated that satisfaction with content increased the odds of the intention to adopt direct DTT without payment. This may be due to a unique condition in South Korea. In general, three terrestrial broadcasting companies supply a large amount of broadcasting content in Korea. In spite of this unique condition, there is a need to clarify the reason more specifically in future studies. Nonetheless, researchers can infer from these findings that adoption of direct DTT is not identical to the adoption of other innovations. Consequently, the pattern of diffusion for this service may be different from those of other new media services.

Further as to the effect of factors on the intention to adopt direct DTT with willingness to pay, the findings that showed needs was the most powerful factor in this case too. Also, the results indicated that region usefulness cost benefit and awareness were significant factors in this order. Accordingly, researchers could confirm that unlike the case of the intention to adopt direct DTT free of charge the innovative characteristics strongly affected the intention to adopt direct DTT with willingness to pay. From these findings, researchers can infer that factors which affect the diffusion of innovation would be differentiated particularly depending on willingness to pay. Thus, these results suggest that there is a need to consider a differentiated policy based on willingness to pay in the overall implementation of the terrestrial digital transition.

Finally from the findings, the current study suggests that there is a need to differentiate digital transition policy in terms of the process of diffusion of direct DTT. That is in the initial stages policymakers can increase the adoption ratio by meeting the needs of those who are willing to pay for direct DTT. However in the mid to final stages, a promotion policy needs to concentrate on those who are not likely to adopt direct DTT without payment. As shown above the findings indicated that innovation characteristics had no effect on the intention to adopt direct DTT free of charge which means that intenders who want free service would not be likely to voluntarily adopt

DTT. Rather, policymakers need to consider the regional factors of region residential type and mode of reception as the more important factors for those who are only willing to accept free service. From these results, researchers recommend that policymakers consider the implications of providing for a voluntary transition and the implications of providing for a compulsory transition.

CONCLUSION

By subdividing two intentions depending on whether or not potential users are willing to pay for a new service this study showed that the intention to adopt direct DTT with willingness to pay followed the general pattern of diffusion of innovation whereas the intention to adopt direct DTT without payment was not identical to general diffusion pattern. Particularly, unlike the case of willingness to pay intention of direct DTT adoption free of charge was heavily affected by factors such as recognition of the digital transition needs regarding digital transition and satisfaction with the existing broadcast service. However, innovation characteristics were ineffective for predicting the adoption of direct DTT free of charge. Meanwhile, innovation characteristics were strongly influential for predicting the intention to directly adopt DTT with willingness to pay. From these findings, researchers could conclude that factors which affect adoption intention of direct DTT was differentiated depending on whether or not potential users were willing to pay for this service and the results imply that willingness to pay plays a critical role in determining the diffusion of DTT service. Finally, researchers expect that the findings can contribute for countries which are currently implementing digital terrestrial tradition particularly for Asian countries to establish an appropriate plan in accordance with their own condition.

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