



RIETI Discussion Paper Series 10-E-021

# **Empirical Study of IPTV Diffusion: Comparison between Japan and Korea**

**KINUGASA Satoshi**

Bank of Japan

**MOTOHASHI Kazuyuki**

RIETI

**Yeong-Wha SAWNG**

Electronic and Telecommunications Research Institute

**TERADA Shinichiro**

the University of Tokyo



Research Institute of Economy, Trade & Industry, IAA

The Research Institute of Economy, Trade and Industry

<http://www.rieti.go.jp/en/>

April 2010

## **Empirical Study of IPTV Diffusion: Comparison between Japan and Korea**

**Satoshi KINUGASA (Bank of Japan), Kazuyuki MOTOHASHI (the University of Tokyo and RIETI), Yeong-Wha SAWNG (ETRI), and Shin-ichiro TERADA (the University of Tokyo)**

### **Abstract**

This study analyzes a diffusion pattern of IPTV (Internet Protocol TV), based on TAM (Technology Acceptance Model). RIETI conducted a household survey of IPTV to understand factors behind advancement of "digital conversion" of Internet and broadcasting services in Japan.

The results of this survey are compared with those of a similar survey in Korea, conducted by ETRI (Electronics and Telecommunications Research Institute). Our structural equation model (SEM) analysis reveals that "ease-of-use" is an important factor in encouraging non IPTV users in both Japan and Korea to adopt it, but that the path from "usefulness" to "adoption" is stronger for Japanese households. Also in relation to IPTV users' intention to use IPTV, Japanese were directly influenced by "usefulness," while Koreans were not.

Keywords: IPTV, diffusion of innovation, Technology Acceptance Model, Structural Equation Model

JEL Classification: L86, O33

RIETI Discussion Papers Series aims at widely disseminating research results in the form of professional papers, thereby stimulating lively discussion. The views expressed in the papers are solely those of the author(s), and do not present those of the Research Institute of Economy, Trade and Industry.

## **1. Introduction**

Internet Protocol Television (IPTV), the convergence services of television and Internet, is being rapidly developed around the world. Many digital media telecommunications service providers around the world are moving towards triple play offerings by combining voice, video and high speed data services. IP-based technology is being used by the majority of service providers to support such video services, commonly known as IPTV services. Diffusion of new technologies results from a series of individual decisions to start using the new technology, which is often the result of a comparison between the uncertain benefits of it and the uncertain cost of adopting it.

Understanding the factors affecting the choice of users is essential both for researchers studying the diffusion factors and for the manufacturers of this newborn industry. The users' motivation to use IPTV can be categorized as intrinsic factors such as seeking high quality, content-rich, and value added services; and extrinsic factors, which include highly interactive services and interoperable applications with other devices and platforms. IPTV now faces a new set of challenges. Their top priority is to deliver an enhanced experience to audience. IPTV services must meet and exceed quality levels currently offered by traditional TV players. So, providers of IPTV must use the findings from the research to identify factors with favorable characteristics for adoption of the IPTV services.

A history of ITPV service in Japan is not short. The first IPTV service in Japan, BBTB, started in 2003, by Yahoo! Japan. Now IPTV services are provided by internet providers such as KDDI and NTT Plala and CATV providers such as J:COM. However, the diffusion rate of IPTV in Japan is only 2.5%, which is significantly lower than the CATV diffusion rate of about 44.0% in the end of March, 2009 (Ministry of Internal Affairs and Communications, 2009). On the other hand, the diffusion rate of IPTV in Korea is about 17%, even though its service started in July 2006, more than 3 years after Japan. Major IPTV providers in Korea are also internet providers such as KT and SK, which are telecommunication companies such as NTT and KDDI. In addition, the regulatory framework concerning broadcasting and telecommunication services is also similar between both countries.

In this paper, the difference in IPTV diffusion rate between Japan and Korea is analyzed by estimating structural equation model (SEM), based on Technology Acceptance Model (TAM) in the literature of innovation diffusion (Davis, 1989; Rogers, 1995). We use the results of household surveys in Japan, conducted by RIETI and in Korea, by ETRI (Electronics and Telecommunications Research Institute). Our structural equation model (SEM) analysis reveals that "Ease-of-Use" is an important factor for non IPTV users to use it, and that the path from "usefulness" to "adaption" is stronger for Japanese households, and that IPTV users' intention to use IPTV was influenced by "usefulness" directly in Japan, which was not influenced in Korea.

The organization of this paper is as follows. The next section describes the methodology and data in this paper. Then, the results of SEM analysis are provided. We compared the coefficients of SEM by IPTV users and non users, as well as Japanese users and Korean users. The section 4 presents some discussion about the results. And, this paper is concluded with summary of findings and some lines of future research.

## **2. Methodology**

### **2.1 Research Model**

The objective of this study is to empirically investigate the process of diffusion of converged media services by looking at the case of IPTV comparing between Japan and Korea. We designed a conceptual research model by a TAM-based adoption-diffusion model. It asserts that the intention to use the product, IPTV, is a function of three factors; Perceived Ease-of-Use, Perceived Usefulness, and Attitude Toward the Product, IPTV.

The research model consists in applying a TAM-based adoption-diffusion model to IPTV services so as to identify a comprehensive range of factors influencing their diffusion process. The variables selected for the research model are wide-ranging and include major TAM variables. The adoption-diffusion model used in this study is a structural model having Perceived Ease-of-Use, Perceived Usefulness, and Attitude Toward the Product as mediating variables. Intention to Use the Product was selected as outcome variables for acceptance-diffusion model.

## 2.2 Hypothesis

TAM and other adoption-centered theories argue that the diffusion of an innovation within a social network begins when an individual member comes into the awareness of it and communicates his/her knowledge to others within the network. According to this postulate, for an effective diffusion of a new product, a marketer must promote the product in such a way as to create as many early adopters as possible, so that these people would, in turn, convert more consumers into adopters through inter-consumer communication. Factors believed to influence consumers' adoption of innovations vary depending on the researcher, even though many share basic premises on the diffusion process, which have been formulated by influential adoption-diffusion theories such as the theory of diffusion of innovations of Rogers (1995), TRA (Theory of Reasoned Action) by Fishbein & Ajzen (1975), TPB (Theory of Planned Behavior) by Ajzen (1991) and TAM (Technology Acceptance Model) by Davis (1989). Rogers (1995) saw the diffusion of innovations as a progressive process in which the adoption of an innovation, initially only by a small number of people, gradually increases to eventually lead to a mass-market take-up. In other words, Rogers believed that the early phase of innovation adoption was closely linked to the personal innovative tendencies of early users.

Among early adoption-diffusion studies, Rogers & Shoemaker (1971) proposed five factors that influence the rate of adoption and diffusion of a new technology product: relative advantage, compatibility, simplicity, observability and trialability. According to Rogers & Sheomaker (1971), the driving factor of the diffusion process is the relative advantage presented by a new technology product, over the existing product, and that the more the innovative product corresponds to consumers' desire, beliefs, values and personal experience, the greater the extent and speed of its diffusion. They further claimed that the simpler an innovative product, the faster the rate of diffusion, as the Ease-of-Use of a new technology facilitates its broad take-up and, in some cases, even trumps price considerations. An eye-catching new product, they also maintained, has a better chance of being quickly adopted by the mass-market, and odds for market success are greater for products that can be tried in advance of purchase, without financial risk to consumers. Robertson & Gatignon (1986), in a study on the adoption of innovative cutting-edge products

among industrial buyers, advanced the view that a competitive supplier-side environment influenced the demand-side competition environment, thereby, also influencing the diffusion of new technology products. Here, the competitive environment has as its key components, industrial competitiveness, company reputation, technology standardization and vertical inter-firm cooperation. In TAM, a dominant paradigm in today's adoption-diffusion research, attitude and behavioral intention-related variables are believed to influence individuals' actual adoption of innovations, through the intermediary of Perceived Ease-of-Use and Perceived Usefulness (Davis et al., 1989). Lee et al. (2002) report, in their study on the banking industry's adoption of new technology products, that communication was an important predictor of the actual acceptance of new products. In other words, Perceived Ease-of-Use and Perceived Usefulness are determinants of consumers' behavioral intention concerning technology acceptance, and the influence of external variables on technology acceptance is mediated by Perceived Ease-of-Use and usefulness (Agarwal and Karahanna, 2000). Joo and Kim (2004), meanwhile, found, in an investigation of technology acceptance in the internet market, that innovativeness, external environment and organizational characteristics were the three most important determinants of acceptance.

In this study, we draw on the adoption-diffusion model using four key influence factors for technology acceptance in TAM, namely Perceived Ease-of-Use (PEoU), Perceived Usefulness(PU), Attitude Toward the Product(ATP), and intention to use the product(IUP). And other variables also used including simplicity, similarity, complexity, trialability, QoS, compativity, substitution, relative advantage, complimentarity, and satisfaction, as influence factors. Using these variables, we formulated the following hypotheses on the adoption-diffusion of IPTV.

H1: PEoU was positively related with PU.

H2: PU was positively related with ATP.

H3: PEoU was positively related with ATP.

H4: ATP was positively related with IUP.

H5: PU was positively related with IUP.

## 2.3 Data Collection

Empirical data were collected from both users and non-users of IPTV. We designed two different questionnaires for households currently using an IPTV service and households not currently using one.

In Korea, the data were collected through a face-to-face interview conducted at the homes or workplaces of the respondents. The respondents were selected among households residing in four major Korean cities, namely, Seoul, Incheon, Busan and Daegu. 500 total copies of the non-user analysis survey questionnaire were distributed to households that are not currently using IPTV, which broke down by region to 200 copies to Seoul-based households and 100 copies each in Incheon, Busan and Daegu-based households. As for the user analysis questionnaire, designed for households that are currently using IPTV, 250 copies distributed – 100 copies in Seoul and 50 copies each in Busan, Incheon and Daegu. The survey was conducted over a period of one month, between October 15, 2008 and November 14, 2008.

In Japan, on the other hand, the data were collected through a web questionnaire. The respondents were selected among individuals residing all cities in Japan. 1000 total copies of the non-user analysis survey questionnaire were distributed to households that are not currently using IPTV. As for the user analysis questionnaire, designed for households that are currently using IPTV, 1000 copies distributed. The survey was conducted over a period of three weeks, between September 1, 2009 and September 20, 2009. Table 1 compares main features of survey for both countries, and Table 2 shows some characteristics of households in our datasets.

**Table 1 Characteristics of Sample**

Japan	Survey Regions	all the city in Japan
	Survey Conductor	RIETI
	Survey Method	web questionnaire
	Survey Period	2009.09.01-09.20
	Sample No.	N=2000(users=1000, non users=1000)
	cf.	all households also use CATV without 500 of non users
Korea	Survey Regions	Seoul, Incheon, Busan and Daegu
	Survey Conductor	ETRI
	Survey Method	Face to face
	Survey Period	2008.10.15-11.14
	Sample No.	N=750(users=250, non users=500) Seoul: 300, Busan, Daegu and Incheon: 150
	cf.	all households also use CATV

**Table 2 Description of the subjects**

		Japan		Korea		
		N	%	N	%	
Total		2000	100	750	100	
Gender	Male	1430	71.5	379	50.5	
	Femal	570	28.5	371	49.5	
Ages	20s	270	13.5	146	19.5	
	30s	633	31.7	287	38.3	
	40s	640	32	213	28.4	
	50s	334	16.7			
	60s	106	5.3	104	13.9	
	over 70s	17	0.9			
	Occupation	self-employed	253	12.7	143	19.1
	Sales	209	10.5	80	10.7	
	Production	64	3.2	23	3.1	
	Clerical employee	380	19	252	33.6	
	Technical employee	417	20.9	72	9.6	
	Administration	163	8.2	24	3.2	
	Professionals	148	7.4	57	7.6	
	Agriculture, fisheries, and stockbreeder	9	0.5	4	0.5	
	Housewives	113	5.7	69	9.2	
	Students	35	1.8	15	2.0	
	Inoccupation	151	7.6	10	1.3	
	Others	58	2.9	1	0.1	
Graduation	Junior High school	25	1.3	8	1.1	
	Senior High school	617	30.9	260	34.7	
	Under Graduate	33	1.7	31	4.1	
	Graduate	1176	58.8	407	54.3	
	post graduate	149	7.5	44	5.9	
Annual Incomes	0 to 2 million yen	65	3.3			
	2 to 3 million yen	134	6.7			
	3 to 4 million yen	196	9.8			
	4 to 5 million yen	249	12.5			
	5 to 6 million yen	241	12.1			
	6 to 7 million yen	185	9.3			
	7 to 8 million yen	162	8.1			
	8 to 9 million yen	108	5.4			
	9 to 10 million yen	134	6.7			
	10 to 11 million yen	89	4.5			
	11 to 12 million yen	63	3.2			
	over 12 million yen	177	8.9			
	NA	76	3.8			
	do not wish to disclose	121	6.1			
		0 to 2.5 million won			151	20.1
		2.5 to 5.0 million won			436	58.1
		5.0 to 7.5 million won			117	15.6
		over 7.5 million won			46	6.1



## 2.4 Measurement

This study considers variables that are common to the adoption-diffusion model and those that are specific to each of them. Variables specific to the adoption-diffusion model considered in this study include compatibility, observability, similarity, trialability, household innovativeness, communication, complexity, relative advantage, perceived risk and service quality Perceived Ease-of-Use and Perceived Usefulness.

Trialability was measured through the limited period of use, capabilities to use the functions of a product, ability to use the product when needed and performance enhancement resulting from the use of the product (Rogers, 2003). Quality of service was measured by the accuracy, relevance, completeness and comprehensiveness of information provided through a product/service, and the variety of information made accessible by it (Parasuraman et al., 1985). Compatibility refers to the extent to which a new product corresponds to the desire, trust, values and the past experience of a consumer (Rogers, 1995).

Household innovativeness refers to how willing a household is to adopt an innovation (Gatignon and Robertson, 1985), in other words, how rapid a household's adoption of an innovation is, and was measured by curiosity/creativity, risk preference, voluntary simplicity, creative re-use, and multiple use potential (Price & Ridgway, 1983).

As for functional similarity, we took into account the extent to which a consumer, based on his/her personal experience, perceives a product/service as functionally similar to existing ones (Martin & Stewart, 2001). Items used to measure complexity were difficulty of use, complexity of manipulation, understanding of advanced functions and need for explanations on advanced functions (Rogers, 1983).

Substitution effect, corresponding to the relationship between two products/services in which the use of one dispenses the use of the other - in other words, one replaces the other – was measured with regard to TV, internet, mobile phone, DMB and other existing media, in terms of IPTV's potential to substitute their functionalities, the content they provide and the time spent using these media (Li, 2004). Relative advantage was measured by the comparative price advantage of a product/service, ease and speed of manipulation and portability (Moore &

Benbasat, 1991). Complementarity, which describes the relationship between two products/services in which they help each other maximize their usefulness, was measured with regard to the ability to increase the existing media's entertainment potential and usefulness as an information access and communication tool (Jeffers & Atkin, 1996).

Perceived Usefulness was measured through the ability to quickly access information useful to a user, usefulness of a product for conducting purchases and the variety of information made accessible through the product (Davis, 1989).

Perceived Ease-of-Use was measured through ease of using desired functions and convenience of methods for accessing the internet and other manipulations (Davis, 1989; Venkatesh, 2000).

### **3. Analysis and Results**

#### **3.1 Reliability Analysis**

The dependent variables, Perceived Usefulness and Perceived Ease-of-Use, were measured through the technology acceptance instrument developed and validated by Davis (1989). Each variable consists of 7-point Likert scale items with "1" indicating strongly disagree and "7" indicating strongly agree.

In order to testify the reliability and validity of the variables used in TAM, we conducted Cronbach's alpha test for each factor and performed a confirmatory factor analysis. The results of all constructs measured in Table 3 are presented indicating sufficient level of reliability and validity on all measures. The internal consistency reliability analysis resulted in a Cronbach's alpha of .90 or greater for all of the factors. The reliability levels of both PU and PEoU were also over .90 (Nunnally, 1978). Table 3 below presents the measurements of discriminant validity. It revealed that the shared variance among variables was less than the variances extracted by the constructs, the value on the diagonals. This showed that constructs are empirically distinct. In conclusion, the test of the measurement model, including convergent and discriminant validity measures, was satisfactory.

**Table 3. Reliability of Measure and Discriminant Validity through confirmatory factor analysis**

	Simpl.	Comp.	Simil.	Trial.	QoS	Comp.	Innov. Coms.	Innov. Info.	Substit.	Relat. Adva.	Compl.	Satisf.	
(PEoU1) Very functional and easy to use	0.912												
(PEoU2) Ease to use without help	0.909												
(PEoU3) Generally very easy to use	0.923												
(PEoU4) Complex to use		0.890											
(PEoU5) Difficult to understand details		0.936											
(PEoU6) Requiring detailed explan to use		0.883											
(PEoU7) IPTV vs traditional TV			0.459										
(PEoU8) IPTV vs CATV			0.645										
(PEoU9) IPTV vs CS			0.906										
(PU1) Quite often uninterrupted				0.872									
(PU2) Fast Download and Upload				0.846									
(PU3) Very Stable Broadcasting				0.948									
(PU4) Good TV reception sensitivity				0.921									
(PU5) Accurate information is provided					0.875								
(PU6) Information related to desired					0.935								
(PU7) Information is comprehensive					0.917								
(PU8) Variety of information available					0.813								
(PU9) Well with daily leisure habits						0.923							
(PU10) Well with the lifestyle						0.958							
(PU11) Daily life in harmony with IPTV						0.931							
(PI1) Buy new motivation is high							0.835						
(PI2) Always want to buy a new product							0.940						
(PI3) Want to buy a new product							0.945						
(PI4) Collect new product info before anyor								0.793					
(PI5) Rich in new ideas								0.792					
(PI6) Sensitive to new information								0.937					
(PI7) Sensitive to the performance								0.944					
(ATP1) For traditional TV									0.729				
(ATP2) For CATV									0.874				
(ATP3) For CS									0.903				
(ATP4) As family fun										0.562			
(ATP5) As family interests										0.634			
(ATP6) As famili leisure										0.745			
(ATP7) The amount of information collected										0.794			
(ATP8) The quality of information collected										0.901			
(ATP9) Case of exchange views with someone										0.879			
(ATP10) Case of convey any info to anyone										0.790			
(ATP11) Become an important tool in the home											0.913		
(ATP12) Affect the daily lives of family											0.899		
(ATP13) Need to be precious for family											0.931		
(ATP14) Bring efficiency into daily life											0.892		
(ATP15) Vital product and service											0.913		
(ATP16) An important element of family life											0.923		
(IUP2) Required service for life												0.865	
(IUP3) Very convenient service												0.841	
(IUP4) Very useful service												0.897	
(IUP5) Recommend to friends and family												0.934	
(IUP6) I want to use more in the future												0.943	
Cronbach's Alpha	Japan	0.999	0.999	0.970	0.998	0.998	0.998	0.995	0.995	0.997	0.996	0.998	0.997
	Korea	0.998	0.997	0.980	0.997	0.996	0.995	0.994	0.997	0.991	0.983	0.998	0.993
Covariance between Factors	Simpl.	Comp.	Simil.	Trial.	QoS	Comp.	Innov. Coms.	Innov. Info.	Substit.	Relat. Adva.	Compl.	Satisf.	
	Simplicity	-	-0.206		0.563	0.606	0.586						
	Complexity		-	0.130									
	Similarity			-									
	Trialability				-	0.685	0.501						
	QoS					-	0.654						
	Compativity						-						
	Innov. Consumption							-	0.668	0.190	0.276	0.268	0.300
	Innov. Information								-	0.154	0.227	0.196	0.226
	Substitution									-	0.617	0.648	0.630
	Relative Advantage										-	0.608	0.731
	Complementarity											-	0.717
	Satisfaction												-

\*omitted values on covariance matrix if the value is smaller than .10.

**Figure 1. Concept model extending the classical TAM with Household Innovativeness**

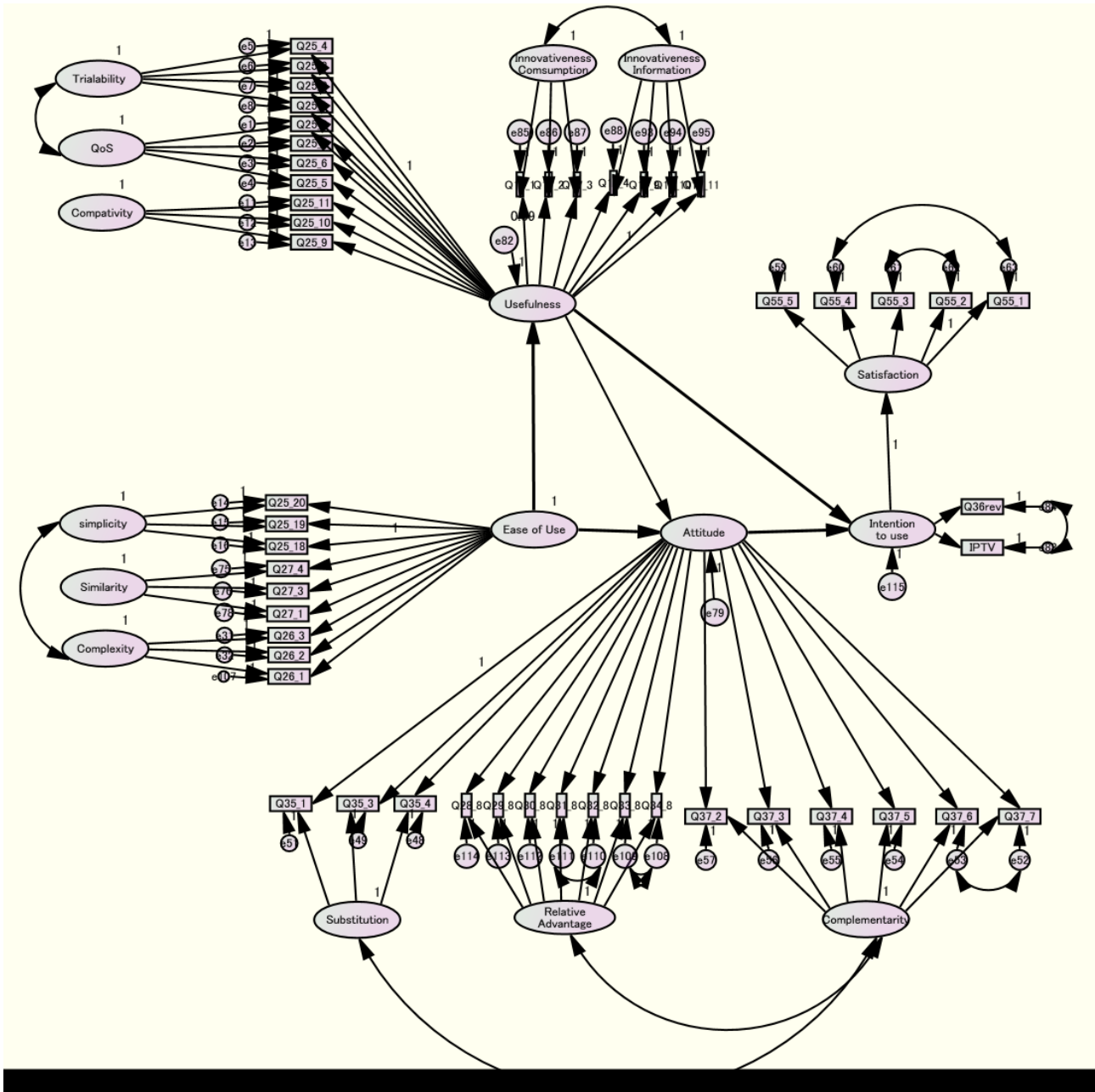


Figure 1 shows an overview of the concept model used for this research. The ellipse in Figure 1 means latent variable, the rectangle shows observed variable, and the small circle shows error variable. Single arrows means beta of regression and factor analysis, and double arrow means covariance between the two parameters. The model proposed includes an extension of the traditional TAM constructs (i.e. PEOU, PU, ATP, and IUP) with Household Innovativeness of

Consumption and Information. In this study we used SEM) to assess the impact of the PEoU, PU, ATP on customer's IUP IPTV in Japan and Korea.

### 3.2 Measurement of model

We performed a structural analysis of the adoption-diffusion model predicting the diffusion of IPTV, using AMOS v.18.0. The goodness of fit of the overall model proved to be highly adequate. As shown in Table 4, the fitness measures were almost all within acceptable range. The results of indicators in Japan, AGFI, CFI and RMSEA, are all significantly to their recommended constructs, while some of them in Korea are little out of recommended values in the literature. Consequently, all the measures indicated that the model fit the data.

The overall fit indices of the structural model were within the range that scholars generally recommend. In both countries cases, we found that all of the influence between observable variance and group factor, Trialability, QoS, Substitution, Complementarity, for example, are 1% significant without Complexity. Hence,

**Table 4. Fit indices for the measurement model**

	CMIN		df		CMIN/df		AGFI		CFI		RMSEA		AIC	
	JPN	KOR	JPN	KOR	JPN	KOR	JPN	KOR	JPN	KOR	JPN	KOR	JPN	KOR
User	3189.5	1952.3	1070	1070	<b>2.981</b>	<b>1.825</b>	<b>0.858</b>	0.716	<b>0.954</b>	<b>0.917</b>	<b>0.045</b>	0.058	3499	2262
Non User	2850.0	2366.3	1070	1070	<b>2.664</b>	<b>2.212</b>	<b>0.879</b>	<b>0.809</b>	<b>0.964</b>	0.896	<b>0.041</b>	<b>0.049</b>	3160	2676
Recommended					<3.0		>0.80		>0.90		<0.050			
Suggested by					(Hayduk, 1987)		(Scott, 1994)		(Bagozzi and Yi, 1988)		(Bagozzi and Yi, 1989)			

In Japanese case, all of them in Table 4 were within acceptable range compared to those recommended in the literature. The ratio of chi-square to degrees of freedom were, which met the recommended criteria of less than 3(Hayduk, 1987). The adjusted goodness of fit index (AGFI) were .858 and .879, respectively. The comparative fit index (CFI) were .954 and .964, respectively. The root mean square Error of Approximation (RMSEA) was .045 and .041, respectively, too. A comparison of these values against those recommended in the literature suggests that the model estimation result is quite satisfactory (cf. Hu and Bentler, 1999). In Korea case, on the other hand,

some measurement –AGFI of Users, CFI of Non User, and RMSEA of Users— were out of the range recommended. This is partly because of the number of samples; Korean survey collected less half size of sample than Japanese survey. In practice, however, these values are considered to indicate a good fit (A. Seyal et.al, 2002).

The structural analysis of the adoption-diffusion model on IPTV was based on TAM. The results of the structural analysis of the adoption-diffusion models on IPTV are showed Table 5 and Appendix A.

We found support for H1, i.e., Perceived Ease-of-Use was positively related with Perceived Usefulness, both for user and non-user, both in Japan and Korea. Moreover, the path from PEOU explained from 72% to 84% of PU(see values of R-square in Appendix A). However, we failed to secure a meaningful relationship between PU and ATP for non-user. Thus, H2 was supported for user but it was rejected for non-user.

**Table 5. Summary of Hypothesis test and Significance test between Users and Non-Users**

			coef.	std.err	t test	Significance Test		
Usefulness	<---	Ease of Use	Japan User	0.545	0.034	15.81	***	-1.146
			Japan Non-User	0.485	0.039	12.40	***	
			Korea User	0.628	0.058	10.81	***	-1.634
			Korea Non-User	0.515	0.037	13.98	***	
Attitude	<---	Usefulness	Japan User	0.815	0.171	4.76	***	-2.139
			Japan Non-User	0.201	0.231	0.87		**
			Korea User	0.829	0.296	2.80	***	-2.140
			Korea Non-User	0.105	0.163	0.65		**
Attitude	<---	Ease of Use	Japan User	0.095	0.102	0.93		1.352
			Japan Non-User	0.325	0.136	2.40	**	
			Korea User	-0.044	0.197	-0.23		1.771
			Korea Non-User	0.348	0.102	3.42	***	
Adoption	<---	Attitude	Japan User	0.903	0.06	14.95	***	0.495
			Japan Non-User	0.942	0.052	18.27	***	
			Korea User	0.895	0.231	3.87	***	0.219
			Korea Non-User	0.96	0.187	5.14	***	
Adoption	<---	Usefulness	Japan User	0.166	0.064	2.60	***	-2.265
			Japan Non-User	-0.027	0.056	-0.48		**
			Korea User	0.102	0.175	0.58		0.539
			Korea Non-User	0.218	0.126	1.74		

\*\*\*:1% significant, \*\*: 5% significant

On the other hand, we succeeded to secure a meaningful relationship between PEOU and ATP for non-user, while we failed to support the relationship between them for user. Thus, H3 was

supported for non-user but it was rejected for non-user. This is an interesting finding because it means that non-user of IPTV significantly consider how he/she can use IPTV easily, while user of IPTV considers whether IPTV is “useful.”

H4 was supported. The better attitude toward IPTV people have, the more intention to use IPTV people have.

H5 was not supporter without user of IPTV in Japan. For all In Korea and for non-user in Japan, although the relationship has been generally assumed in some related research, our empirical analysis revealed that PU was not directly related to IUP. When PU was related to IUP for them, PU was firstly related to ATP which directly related to IUP. Therefore, PU can be related indirectly to IUP. On the other hand, for user in Japan, PU was directly related to IUP, according to Table 5 (coef. = .116,  $p < .001$ ).

#### **4. Discussion**

This study revealed that the adoption diffusion of IPTV can be predicted by TAM ( $R$ -square = .48~.69). Both in Japan and Korea, Perceived Ease-of-Use directly affected Perceived Usefulness, and Attitude Toward the Product directly affected intention to use the product. Notably, contradicting the findings of previous TAM studies, the results of this study indicate that Perceived Usefulness does not motivate non-users to subscribe IPTV, but it directly affects attitude for users. On the other hand perceived easiness of use drives non-users' Attitude Toward the Products. IPTV service offers superior services to ordinal TV in a sense of VOD and interactive communications with contents providers. However, such marginal utilities may be difficult to be perceived without actual usage. Therefore, a positive and significant path from Perceived Usefulness to Attitude Toward the Product can be observed only for users. On the other hand, perceived easiness of use is more important for non users since IPTV may be perceived as more advanced services than watching ordinal TV.

In addition, this study found evidence that Perceived Usefulness, one of the key mediators in the adoption-diffusion model by Davis (1989), do not have an influence directly on the diffusion outcome, while that Perceived Usefulness of users do have an significant influence

indirectly on the diffusion outcome through Attitude Toward the Product. Again, IPTV is not a service which potential users with perception of usefulness would jump on. Instead, it is first to draw attention to the services, then some potential users overcome economical and psychological barriers existing between attention to actual adoption.

In terms of cross country comparison, we have found similar results for most of paths. However, there are some differences, particularly in the paths from Perceived Usefulness. One difference is that a direct influence from Perceived Usefulness to adoption in Japan, while there is not such relationship in Korea. There are some ways to explain such difference. For example, the first difference can be explained by the stage of IPTV diffusion in both countries. In Rogers' diffusion model, five types of users are identified by the timing of adoption, i.e., innovators, early minorities, early majorities, late majorities and laggards (Rogers, 2005). In Japan, since the diffusion rate of IPTV is only 2.5%, most of current users can be categorized as "innovators", while early minority users also exist in Korea, whose diffusion rate is around 17%. Innovators are just technology lovers, who tend to jump on new product. Therefore, a positive and significant path can be found from Perceived Usefulness to adoption directly. Another possible explanation is a difference in consumer taste between two countries, in a sense that the Japanese put more value on usefulness as compared to the Korean. This may be related to the difference in another difference in the path from Perceived Usefulness to Attitude Toward the Product. In Korea, a positive and significant path can be found only in IPTV users, while it is found only in non IPTV users in Japan. It should be noted that Perceived Usefulness, as well as easiness of use, is important for attention even before its subscription for the Japanese, while only perceived easiness is important for the Koreans.

## **5. Conclusions**

In this paper, the difference in IPTV diffusion rate between Japan and Korea is analyzed by estimating structural equation model (SEM), based on Technology Acceptance Model (TAM) in the literature of innovation diffusion (Davis, 1989; Rogers, 1995). We use the results of household surveys in Japan, conducted by RIETI and in Korea, by ETRI (Electronics and Telecommunications Research Institute).



Our structural equation model (SEM) analysis reveals that "Ease-of-Use" is an important factor for non IPTV user to use it. In addition, a direct influence of "Perceived Usefulness" to "adoption" is not observed in general, while its indirect path through "attention to the product" is important. Therefore, it is important for IPTV provider to draw attention of potential users by stressing the easiness of use. In addition, promotion with free trial period may be an effective marketing tool, to convince non users about its usefulness.

In terms of cross country difference, a direct path from "usefulness" to "adaption" can be found in Japanese users, while such relationship cannot be found for the Koreans. This can be explained by difference in the stage of diffusion across countries, in a sense that only innovators adopt IPTV in Japan, while early minorities is also using it in Korea. Another possible explanation is cross country difference in consumer taste. We have found a stronger preference in Perceived Usefulness in Japan, so that appropriate marketing campaign by Japanese providers may be different from Koreans, by addressing functions and features of IPTV as well as its easiness of use to potential customers.

This paper sheds new light on the diffusion pattern of new digital convergence services in Japan and Korea. The results of our estimated structural equation models revealed commonality and differences in the mechanism of innovation diffusion, which implies some difference in consumer taste in both countries. However, it is still a long way to go to narrow down more details in the taste. This is one area for us to investigate further in a next project. In addition, it is important for us to work on dynamic model, instead of static SEM used in this paper. Another point to be investigated is a difference in the speed of IPTV diffusion between two countries.

## **Reference**

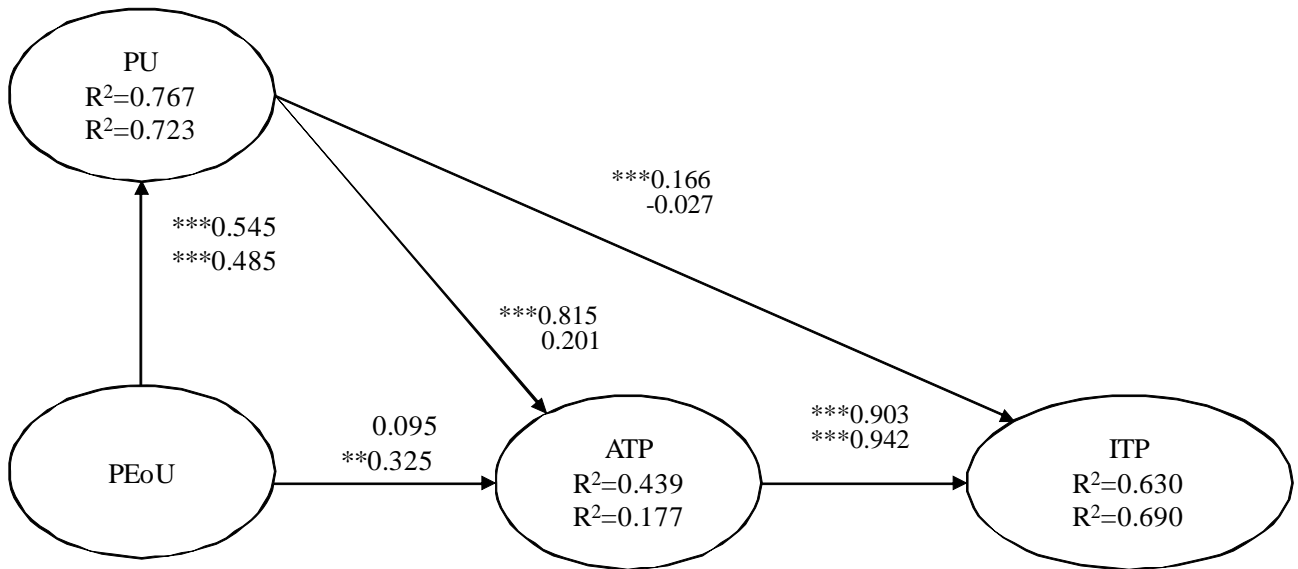
- Agarwal, R. & Karahanna, E. (2000), "Time flies when you're having fun: cognitive absorption and beliefs about information technology usage," *MIS Quarterly*, 24,4, 665-694.
- Ajzen, I., & Fishbein, M. (1980), "Understanding attitudes and predicting social behavior." Englewood Cliffs, N.J.: Prentice-Hall.

- Bagozzi, R., Yi, Y. (1988), "On the evaluation of structural equation models," *Journal of the Academy of Marketing Science* 16, pp. 74–94.
- Cao & Mokhtarian(2005), "The Intended and Actual Adoption of Online Purchasing: A Brief Review of Recent Literature," UC Transportation Center
- Davis, F.D. (1989), "Perceived usefulness, perceived ease of use, and user acceptance of information technology," *MIS Quarterly*, 13 (3), 319-339.
- Davis, F.D., Bagozzi, R.P. & Warshaw, P.R. (1989), "User acceptance of computer technology: a comparison of two theoretical models," *Management Science*, 35 (8), 982-1003.
- Fishbein, M., & Ajzen, I. (1975), "Belief, attitude, intention and behavior: An introduction to theory and research. Reading," MA: Addison-Wesley.
- Gatignon, H. A., and Robertson, T. S. (1985), "A propositional inventory for new diffusion research", *Journal of Consumer Research*, Vol. 11, 849–867.
- Ha, I, Yook, S (2009) "The Effects of Media Characteristics on IPTV Adoption," PICMET 2009 Proceedings, August 2-6, Portland, Oregon USA
- Ha, I, Yoo, J, Choi, J, Jong, S, Kim, S, Chin, Y (2009), "Adoption of IPTV under the Convergence of Broadcasting and Telecommunications," Feb. 15-18, 2009 ICACT 2009
- Hayduck L. (1987), "Structural Equation Modeling with LISREL," Johns Hopkins University Press, Baltimore, MD.
- Hu L, Bentler PM (1999), "Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives," *Struct Equ Modeling* 1999;6(1): 1–55.
- Jang Dae-ryeon & Jo Seong-do (2002), "A Study on Users of High-Tech Products on Resistance Against Innovation within Organizations, and Control Effects of Perceived Self-Capability," *Korean Society of Consumer Studies*, Vol. 13, No. 3, September 2002, pp.245~262.
- Jeffres, L. & Atkin, D.(1996), "Predicting Use of Technologies for Consumer and Communication Needs", *Journal of Broadcasting and Electronic Media*, 40, 318-330.
- Joo, Y.B., Kim, Y.G. (2004), "Determinants of corporate adoption of e-marketplace: an innovation theory perspective", *Journal of Purchasing and Supply Management*, Vol. 10 No.2, pp.89-101.

- Jöreskog, K. G. (1969), "A general approach to confirmatory maximum likelihood factor analysis." *Psychometrika*, 34, 183-202.
- Jöreskog, K. G. (1973), "A general method for estimating a linear structural equation system. In *Structural equation models in the social sciences*," (A. S. Goldberger & Duncan, Eds.) pp.85-112. Seminar Press: New York.
- Lee, E-J., Lee, J., Schumann, D.W. (2002), "The influence of communication source and mode on consumer adoption of technological innovations", *Journal of Consumer Affairs*, Vol. 36 No.1, pp.1-27.
- Li, Shu-Chu Sarrina (2004), "Exploring the Factors Influencing the Adoption of Interactive Cable Television Services in Taiwan", *Journal of Broadcasting and Electronic Media*, 48(3), 466-483.
- Martin, I. M., and Stewart, D. W.(2001), "The Differential Impact of Goal Congruency on Attitudes, Intentions, and the Transfer of Brand Equity", *Journal of Marketing Research*, 38, 471-484.
- Ministry of Internal Affairs and Communications (2009), "State of Cable Television Penetration," Press Release-Telecom,  
[http://www.soumu.go.jp/main\\_sosiki/joho\\_tsusin/eng/Statistics/pdf/090612\\_1.pdf](http://www.soumu.go.jp/main_sosiki/joho_tsusin/eng/Statistics/pdf/090612_1.pdf)
- Moore, G. C., & Benbasat, I. (1991), "Development of an Instrument to Measure the perceptions of Adopting an Information Technology Behavior", *Information Systems Research*, 2(3), 192-222.
- Nunnally, Y. J. (1978), "Psychometric theory," New York: McGraw Hill.
- Parasuraman, A. V., A. Zeithaml, and Berry, L. L.(1985), "A Conceptual Model of Service Quality and Its Implications for Future Research", *Journal of Marketing*, 49, 41-50.
- Price, L. L. & Ridgeway, N. M.(1983), "Development of a Scale to Measure Use Innovativeness", in *Advances in consumer Research*, 10, 679-684.
- Robertson, T. S.; & Gatignon, H(1986), "Competitive Effects on Technology Diffusion." *Journal of Marketing*, Volume 50, pp. 1-12.
- Rogers, E. M. & Shoemaker, Floyd F (1971), "Communication of Innovations: A Cross-Cultural Approach (2nd ed.)". New York: The Free Press.
- Rogers, E. M. (2003). "Diffusion of innovations (5th ed.)". New York: Free Press.
- Rogers, E. M. (1995), *The Diffusion of Innovations*, 4th ed. New York: Free Press.

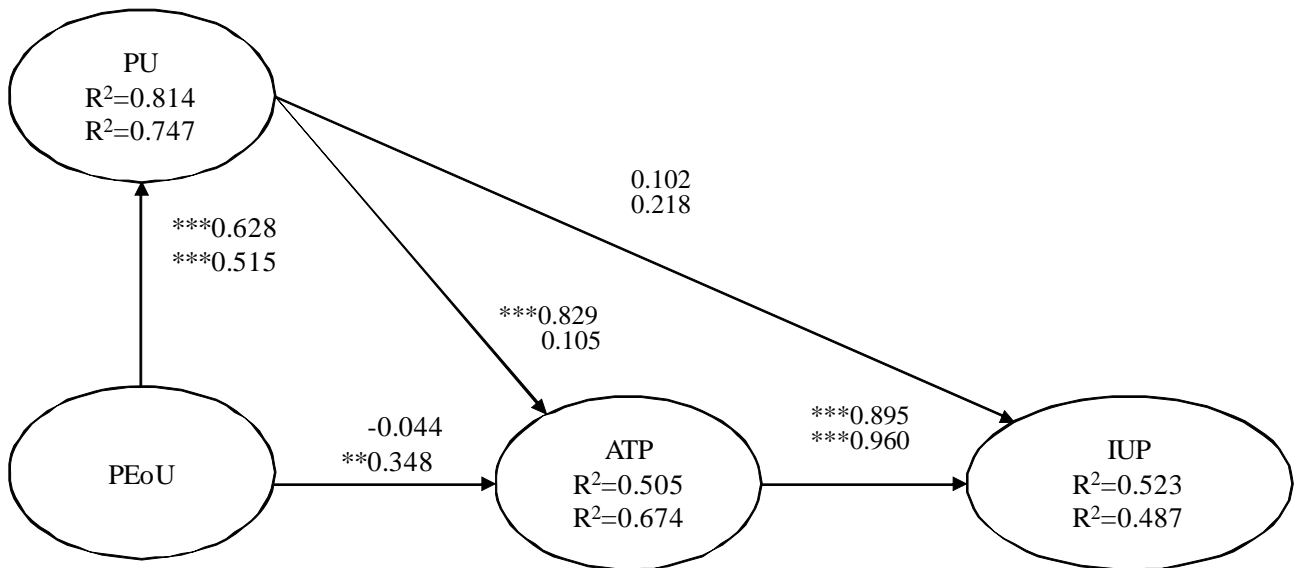
- Scott J. (1994), "The measurement of information systems effectiveness: evaluating a measuring instrument,"  
in: Proceedings of the Fifteenth International Conference on Information Systems, Vancouver, BC,  
pp. 111–128.
- Shin. Y, Jeon. H, Choi. M (2008), "Analysis on the Mobil IPTV Adoption and Moderator Effect Using Extended  
TAM Model," 4<sup>th</sup> International Conference on Networked Computing and Advanced Information  
Management
- Venkatesh, V. (2000), "Determinants of Perceived ease-of-use: Integrating Control, Intrinsic Ease of Use:  
Integrating Control, Intrinsic Motivation, and Emotion into the Technology Acceptance Model",  
Information System Research, 11(4), 342-365.
- Yoo. J, Choi. J, Kim. S, Yang. J, Jong. S (2009), "Factor Affecting the Switching Intention of IPTV  
Subscribers," Feb. 15-18, 2009 ICACT 2009

**Appendix A**



Above: user, Below: non-user, \*\*\*:1% significant, \*\*: 5% significant

**Figure A1. Results of SEM in Japan**



Above: user, Below: non-user, \*\*\*:1% significant, \*\*: 5% significant

**Figure A2. Results of SEM in Korea**

## Appendix B

**Table B. Summary of Hypothesis test and Significance test between Japan and Korea**

			coef.	std.err	t test	Significance Test	
Usefulness <---	Ease of Use	User	Japan	0.545	0.034	15.81 ***	1.214
			Korea	0.628	0.058	10.81 ***	
		Non-User	Japan	0.485	0.039	12.40 ***	0.573
			Korea	0.515	0.037	13.98 ***	
Attitude <---	Usefulness	User	Japan	0.815	0.171	4.76 ***	0.043
			Korea	0.829	0.296	2.80 ***	
		Non-User	Japan	0.201	0.231	0.87	-0.330
			Korea	0.105	0.163	0.65	
Attitude <---	Ease of Use	User	Japan	0.095	0.102	0.93	-0.617
			Korea	-0.044	0.197	-0.23	
		Non-User	Japan	0.325	0.136	2.40 **	0.132
			Korea	0.348	0.102	3.42 ***	
Adoption <---	Attitude	User	Japan	0.903	0.06	14.95 ***	-0.031
			Korea	0.895	0.231	3.87 ***	
		Non-User	Japan	0.942	0.052	18.27 ***	0.091
			Korea	0.96	0.187	5.14 ***	
Adoption <---	Usefulness	User	Japan	0.166	0.064	2.60 ***	-0.355
			Korea	0.102	0.175	0.58	
		Non-User	Japan	-0.027	0.056	-0.48	1.782
			Korea	0.218	0.126	1.74	

\*\*\*:1% significant, \*\*: 5% significant