Factors Influencing New Media Subscription Based on Multigroup Analysis of IPTV and DCTV

Sang-ug Kang, Seungbum Park, and Sangwon Lee

As the Internet Protocol TV (IPTV) service enters the broadcasting market, the competition intensifies. This paper explains the factors influencing new media subscription and their influential differences on IPTV and digital cable TV (DCTV). We use the information systems success model and gratification opportunity theory to develop our research model. We sample 621 people and collect their responses through web-based measuring software. Structural model analysis shows that the willingness to subscribe to a new broadcasting medium is influenced by three characteristics of the medium: media richness, interactivity, and video quality. Multigroup analysis reveals that motivation to use a medium partially differs between IPTV and DCTV. This research concludes that the IPTV service is not attractive enough to act as a substitute for the already existing DCTV. In addition, for the IPTV service to proliferate, its business model should be promoted with new and differentiated revenue structures and services. The managerial implications in this study help new media businesses set business goals and product functionality, and allocate resources for the continued diffusion of IPTV.

Keywords: IPTV, DCTV, structural equation model, gratification opportunity theory, multigroup analysis of structural invariance.

I. Introduction

The total number of Internet Protocol TV (IPTV) subscriptions worldwide was expected to grow to 81 million in 2013 (from 27 million in 2009) and in-service revenue to $200 billion in 2012 (from $67 billion in 2009) [1]. Such anticipated changes in the broadcasting market have brought about competition among heterogeneous broadcast business operators for the limited number of audience members. In this competitive situation, the audience should consider the benefits that an IPTV service provides over traditional digital cable TV (DCTV) or terrestrial broadcasting (TB) services, while also considering the additional cost of switching to the IPTV service.

Recent research on IPTV has been myopic in that it analyzes factors affecting media adoption without considering the competitive environment among the media. Our research defines the common characteristics of this new broadcasting media and measures their effects on the audience's willingness to subscribe. We use the information systems success model and gratification opportunity theory to develop our research model. We sample 621 people and collect their responses through web-based measuring software.

II. Research Model and Theoretical Background

A new broadcasting medium is defined as an information system–based cyber service that provides information content integrated by broadcasting and communication [2]. From the information system perspective, this research proposes three key characteristics affecting the audience's attitude toward willingness to subscribe to a new media service: media richness (information quality), interactivity (service quality), and video quality (system quality). These three characteristics

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are the major performance-measuring indicators in the information systems success model [3]–[4]. These characteristics positively affect the audience's intention to use and perceived satisfaction with an information system, as well as a system's perceived usefulness and ease of use [4]. According to the Servqual (service quality) model, service quality is defined to include factors such as responsiveness, perceived control, user experience, credibility, and sympathy [7]–[9]. Interactivity, the most prominent new media characteristic, is also described as a form of perceived responsiveness, user engagement, and control, this is in keeping with previous studies' reports on service quality [10]–[11]. Interactivity has been recognized as an exogenous variable that influences perceived usefulness and ease of use [12]–[13]. DeLone and McLean proposed that information quality is measured by variety, which is the major factor inducing information system use in the Internet environment [4]. In particular, new media acceptance relies on what a medium can provide media users with regard to information [14]. Content richness of the digital environment has produced a range of choices, which positively influences new media subscription via perceived ease of use and usefulness [15]. System quality also means the technological and operational efficiency of system functions and includes elements such as system errors, response ratings, and system credibility [3], [4]. In the new broadcasting media utilization environment, all system quality issues, such as transmission rate, transmission quality, and stability of network bandwidth for transporting content, converge on user-perceived video quality [16]–[18]. To support interactive communication and maintain high-definition video quality, a transmission speed of more than 15 Mbps should be consistently maintained [19]. Also, from the IPTV perspective, the offer of a "triple-play service (TPS)" (high-speed Internet access, voice over IP, and video on demand (VoD)) raises the issue of how to measure and manage user-perceived video quality, including user experience and emotion, as well as the quality of service (QoS) [20]–[21]. In this sense, the high video quality of a new media device is recognized as a core element for the full-fledged diffusion of a new media service [19]. Therefore, we propose the following hypotheses to prove the relationship between new media characteristics (interactivity, media richness, and perceived video quality), users' attitudes toward the new media service (perceived usefulness and ease of use), and users' willingness to subscribe to new media:

- H1: Interactivity is positively related to perceived usefulness in the new media service environment.
- H2: Interactivity is positively related to perceived ease of use in the new media service environment.
- H3: Interactivity is positively related to the willingness to subscribe in the new media service environment.
- H4: Media richness is positively related to perceived usefulness in the new media service environment.
- H5: Media richness is positively related to perceived ease of use in the new media service environment.
- H6: Media richness is positively related to the willingness to subscribe in the new media service environment.
- H7: User-perceived video quality is positively related to perceived usefulness in the new media service environment.
- H8: User-perceived video quality is positively related to

Table 1. Technology comparison of IPTV and DCTV broadcasting: revised from [5] and [6].

Item	IPTV	DCTV	Comments
Interactive service	Full interactivity (excellent with a hard disk in the STB)	Limited interactivity (good without a hard disk in the STB)	A hard disk in the STB makes a difference.
Personalization service	User centric: PVR, VoD (hard disk required)	Limited user centric (hard disk not required)	
Channel capacity	Full capacity (determined by metrocore network bandwidth)	Good: limited capacity	Cable TV needs an SDV or adoption of IP to provide good channel capacity.
3-screen service	Excellent with the flexibility of IP		No buffering is required for VoD service.
VoD, game, T-commerce, T-gov, and so on	For interactive services, STB with a hard disk advantageous	Cable STB equipped with a hard disk for the same level of services	
Video/audio compression	Video: MPEG-4 Audio: AAC	Video: MPEG-2/4 Audio: AC-3	MPEG-2 and AC-3 are used in TB.
Video quality	Worse than TB	Identical with TB	
QoS	QoS not guaranteed	QoS guaranteed	
Channel change response time	Slow (≤ 3 sec)	Reasonable (≤ 1.5 sec)	

Note. AAC: advanced audio compression; AC: audio compression; PVR: personalized video recorder; SDV: switched digital video; TS: transport stream; and STB: set-top box.

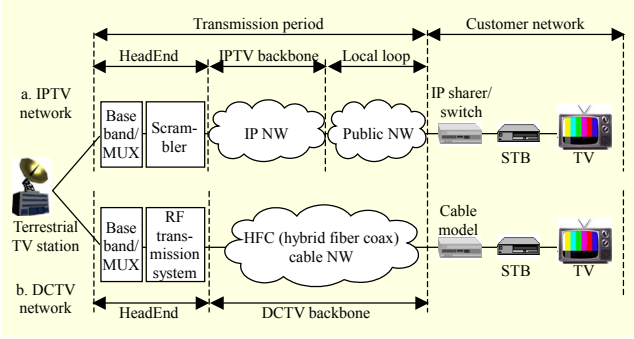

Fig. 1. Configuration of IPTV and DCTV network architecture.

perceived ease of use in the new media service environment.

- H9: User-perceived video quality is positively related to the willingness to subscribe in the new media service environment.
- H10: Perceived usefulness is positively related to the willingness to subscribe in the new media service environment.
- H11: Perceived ease of use is positively related to the willingness to subscribe in the new media service environment.

If a brand-new medium can more effectively satisfy users's wants, then it will substitute any existing media currently providing those users [22]–[23]. In this case, multiple media types thought to be similar are considered as alternatives by the audience [16]–[24] — for instance, interactive broadcasting media such as IPTV, DCTV, and satellite broadcasting. The aforementioned brand-new medium follows gratification opportunity theory to intensify the use and gratification desire of the audience. Dimmick (2000) asserted that the gratification opportunity–seeking desire to select a new medium is strengthened since new media, such as the VCR and the Internet, have fewer constraints than traditional media with regard to content offering and the broadcasting program delivery method [25]. This paper researches factors influencing new media acceptance, focusing on IPTV and DCTV from the gratification opportunity perspective.

The strong advantages of IPTV (see Table 1) include virtually an unlimited number of channels and the flexibility of developing IP-based services. These features enable IPTV to easily provide a Closed User Group (CUG) service and to expand an N-screen service that can connect the web, mobile communication, and TV. The advantages of DCTV include higher video quality and quick channel change response. As shown in Table 1, because of the inherent nature of transcoding from Moving Pictures Expert Group (MPEG)-2 to MPEG-4, which exacerbates the video quality, the video quality of IPTV is worse than that of DCTV. However, the decisive factor is the difference between the transmission methods. In DCTV, all broadcasting channels are delivered to the STB through a dedicated line, as shown in Fig. 1. In IPTV, IP packets that come out of the head end are delivered to each subscriber network through a public network (local loop), where some video images are lost because of the network providers' line capacity or maintenance status. Errors, such as blocking and blurring, are propagated to the next image and pile up [26], decreasing the user-perceived video quality. These technical assertions have not yet been empirically proven by end users subscribing to new media services. However, we can argue that a comparison study on the two media services, considering consistencies in methods and dependent variables, such as perceived usefulness, ease of use, and willingness to subscribe, can empirically verify the asserted differences.

Thus, we deduced the following hypothesis regarding the dependent variables' influential differences by media type:

- H12a: The influence of interactivity on perceived usefulness is more positive in the IPTV service environment.
- H12b: The influence of interactivity on perceived ease of use is more positive in the IPTV service environment.
- H12c: The influence of interactivity on the willingness to subscribe is more positive in the IPTV service environment.
- H13a: The influence of media richness on perceived usefulness is more positive in the IPTV service environment.
- H13b: The influence of media richness on perceived ease of use is more positive in the IPTV service environment.
- H13c: The influence of media richness on the willingness to subscribe is more positive in the IPTV service environment.
- H14a: The influence of user-perceived video quality on perceived usefulness is more positive in the DCTV service environment.
- H14b: The influence of user-perceived video quality on perceived ease of use is more positive in the DCTV service environment.
- H14c: The influence of user-perceived video quality on the willingness to subscribe is more positive in the DCTV service environment.

III. Research Method and Measurement Development

This research defines video quality as the user-perceived quality that a user experiences and subjectively recognizes for a video image [2]. We score the value of user-perceived video quality, measured with specially designed software, on a Likert-type five-point scale (1 = completely bad to 5 = completely good) following international standards [2].

Interactivity means the degree of possibility of reciprocal communication between people, or between people and machines, in the communication media utilization environment [27]. Interactivity is described as a concept of coordination

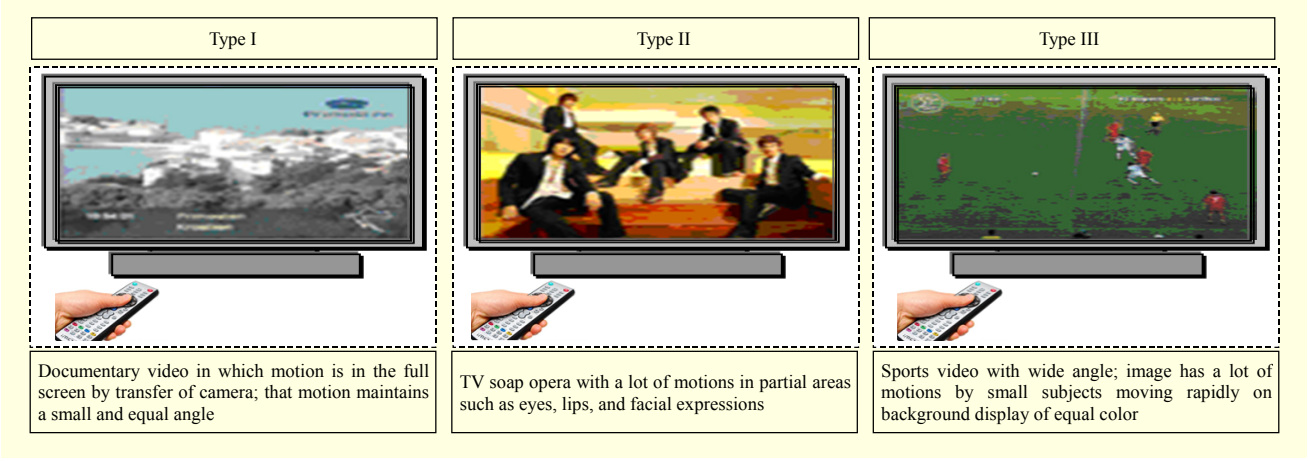

Fig. 2. Examples of test videos.

between function and message connectivity–focused views [10]–[11]. Conforming to this thought, we defined interactivity as a second-order construct with formative first-order factors composed of perceived control and responsiveness as the function-focused view and perceived user engagement as the message connectivity–focused view. A nine-item, seven-point scale was used to measure interactivity (1 = completely dissatisfied to 7 = completely satisfied). Media richness was defined and measured as previously developed by Dimmick [25], [28]–[29]. A three-item, seven-point scale was used to measure media richness (1 = completely dissatisfied to 7 = completely satisfied). Davis's definition and a six-item, seven-point Likert-type scale (1 = completely dissatisfied to 7 = completely satisfied) were used to measure perceived usefulness and perceived ease of use with necessary modifications being made only to Davis's definition [30]. Wang's definition and a three-item, seven-point scale (1 = strongly disagree to 7 = strongly agree) were used to measure the willingness to subscribe [31]. Gender, age, and perceived price have been shown to influence new media adoption [32]–[33]. As control variables, we examined the influence of these three factors on the willingness to subscribe. Sample data was obtained using a survey titled "Development on IPTV Quality Estimation and IPTV Service Promotion" [34], conducted by the Korea Communications Commission (www.kcc.go.kr) to set up a basic IPTV quality estimation plan and a mid-/long-term plan to promote IPTV's early adoption to the market. Internet advertisements (http://speed.nia.or.kr and other sites) and an online panel surveyors' list were used to acquire a sufficient number of viewers as evaluators.

At this stage, the viewers were asked to submit receipts of IPTV/DCTV subscription and information on the IPTV/DCTV-watching environment in their homes. An evaluation team was formed with 621 people selected from viewers having over three months of IPTV/DCTV service

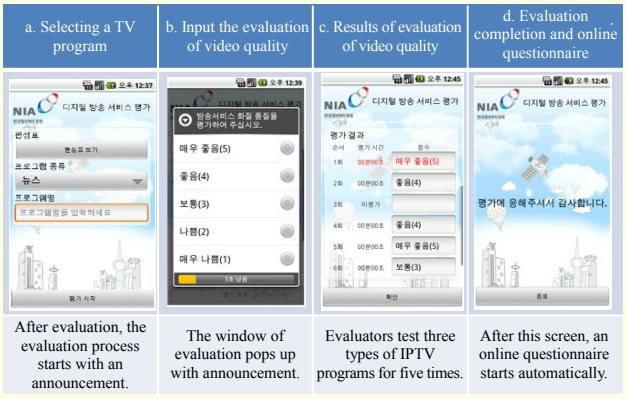

Fig. 3. Example of survey process.

subscription; thus, we were able to satisfy the video quality test environment requirements of the International Telecommunications Union (ITU) [2]. Of those people, 511 had used IPTV, whereas 110 had used DCTV; 57.9% were males and 42.1% females. The majority were in their twenties or thirties — teens amounted to only 6.4%, while 33.7% were in their twenties, 39.9% in their thirties, 15.8% in their forties, and 4.2% over fifty. In addition, 78.3% lived in cities and 21.7% in rural areas. To measure the effects of the characteristics of new media on the users' attitude and willingness to subscribe, we developed a website and a software application that ran on smartphones and personal computers (PCs). For subjective assessment of video quality, we chose a measurement method based on international standards — the Single Stimulus method [2] by the ITU.

The measurement steps in this research were as follows. Participants downloaded the measurement software to their smartphone or PC. After installing the software, they filled out their gender, age, and experience with high-speed Internet services. Next, they read the survey scenario based on a list of actions (such as available TV programs, the security policy,

Table 2. Properties of measurement scales.

	CFA			Correlation matrix						AVE matrix					
	λ	α	CR	1	2	3	4	5	6	1	2	3	4	5	6
1. MR	0.941/0.963	0.968	0.918	1						0.790					
2. QE	0.837/0.909	0.898	0.935	0.611	1					0.373	0.906				
3. IA	0.956/0.976	0.964	0.906	0.162	0.150	1				0.026	0.022	0.861			
4. PE	0.934/0.944	0.960	0.910	0.602	0.612	0.137	1			0.363	0.375	0.019	0.746		
5. PB	0.925/0.954	0.943	0.853	0.584	0.521	0.177	0.457	1		0.341	0.272	0.031	0.209	0.773	
6. WS	0.868/0.972	0.980	0.948	0.596	0.562	0.125	0.581	0.414	1	0.355	0.315	0.016	0.338	0.171	0.645

Note 1. λ = factor loading (min/max); α = Cronbach alpha; CR: composite reliability; AVE: average variance extracted; MR: media richness; QE: quality of experience; IA: interactivity; PE: perceived ease of use; PB: perceived benefit; WS: willing to subscribe.

Note 2. GFI = 0.964, AGFI = 0.917, NFI = 0.988, NNFI = 0.993, and RMSEA = 0.028.

Note 3. Exploratory factor analysis (EFA) of all our scale items revealed three factors explaining 74.48% of the variance in our study's constructs, with the first factor explaining 58.1% and the last factor explaining 4.8% of the total variance. This analysis suggests that our data sample was not likely contaminated by common method bias.

Table 3. CFA model comparison.

Model	χ^2	df	AGFI	RMSEA	$\Delta\chi^2/\Delta$df	$\Delta\chi^2$ Sig. Dif.
Unconstrained (model 1)	356.639	240	0.917	0.028		
ϕ constrained (model 2)	396.319	255	0.916	0.030	39.68/15	Yes
λ constrained (model 3)	374.135	252	0.918	0.028	17.496/12	No
ϕ, λ constrained (model 4)	413.350	267	0.917	0.030	56.711/27	Yes

Note. λ = factor loading; ϕ = covariance.

and grading method). After selecting five TV programs from three available genres (drama, sports, and documentary film) and watching ten minutes of each program (Figs. 2, 3(a), and 3(b)), they evaluated the video quality of each program five times (Fig. 3(c)). Test scores were synthetically scored by a Likert-type scale and then summed for quantification. After measuring video quality, the software automatically connected the participants to the online survey screen asking for responding questionnaires of other research variables (Fig. 3(d)). Finally, the participants were debriefed and thanked, and then access was terminated.

IV. Results

Multigroup analysis of structural invariance (MASI) was conducted to test whether path coefficients in the IPTV and DCTV groups were statistically different. MASI was performed through multigroup confirmatory factor analysis (CFA) and multigroup structural model analysis on the basis of the cross-group equality constraints method [35]–[36].

Multigroup CFA enables verification of the model structure or its individual parameters for factorial invariance across subgroups [37]. The factorial invariance test requires a sequential demonstration that conditions of equal patterns (configuration, model 1), equal covariances (ϕs, and equal item–factor loadings (λs) are satisfied (models 2–4) [38]–[39]. First, following Myers (2000), model 1 (unconstrained model) was estimated, in which the factor loadings (λs) for every construct were free across the two groups (Tab1e 2). Model 1 evaluated configural invariance (equal patterns) and produced $\chi^2 = 356.639$ with degrees of freedom (df) = 240. Table 2 also indicates that the results of CFA for model 1 supported high convergent and construct validity. Model 2 (ϕ-constrained model) was estimated to test whether the factor covariances were equal across the two groups (Table 3) by constraining the covariances (ϕ) to be equal. Model 2 produced $\chi^2 = 396.319$ with df = 255. The chi-square difference of models 1 and 2 showed significance at $p < 0.05$ ($\Delta\chi^2 = 39.68$; df = 15). This indicated that the factor correlations were not invariant across the two groups. Model 3 (λ-constrained model) was estimated to determine whether the measurement model was the same across the two groups. To evaluate this model, factor loadings (λs) were constrained across the two groups. The difference between models 1 and 3 showed nonsignificant results ($\Delta\chi^2 = 17.496$; df = 12), which means that the measurement scale was assumed to be equal across both groups. Also, model 4 (constraining both ϕ and λ models) showed a significant difference with model 1 ($\Delta\chi^2 = 56.711$; df = 27). There was a

Table 4. Summary of hypotheses results.

Path				IPTV			DCTV		
				Coefficient	Standard error	Result	Coefficient	Standard error	Result
H1	IA	→	PU	0.391***	0.037	Supported	0.368***	0.072	Supported
H2	IA	→	PE	0.252***	0.040	Supported	0.272**	0.074	Supported
H3	IA	→	WS	0.166***	0.045	Supported	0.138	0.095	Not supported
H4	MR	→	PU	0.347***	0.038	Supported	0.427***	0.076	Supported
H5	MR	→	PE	0.406***	0.041	Supported	0.444***	0.077	Supported
H6	MR	→	WS	0.181***	0.046	Supported	0.371***	0.108	Supported
H7	QE	→	PU	0.012	0.071	Not Supported	0.059	0.118	Not supported
H8	QE	→	PE	0.069	0.077	Not Supported	0.081	0.120	Not supported
H9	QE	→	WS	0.036	0.077	Not Supported	0.024	0.139	Not supported
H10	PU	→	WS	0.250***	0.048	Supported	0.109	0.112	Not supported
H11	PE	→	WS	–0.008	0.044	Not Supported	–0.029	0.110	Not supported

Note 1. * Significant at $p < 0.1$, ** significant at $p < 0.05$, and *** significant at $p < 0.01$.
Note 2. GFI = 0.943, AGFI = 0.869, NFI = 0.911, NNFI = 0.868, and RMSEA = 0.075.

Table 5. Summary of hypotheses results: path-constrained model.

Path				DF	CMIN	P	TLI	Result
H12a	IA	→	PU	1	4.584	0.032**	–0.017	Supported
H12b	IA	→	PE	1	0.015	0.904	–0.017	Not supported
H12c	IA	→	WS	1	4.242	0.039**	–0.017	Supported
H13a	MR	→	PU	1	5.455	0.020**	–0.015	Reputed
H13b	MR	→	PE	1	0.168	0.682	–0.017	Not supported
H13c	MR	→	WS	1	3.420	0.064	–0.013	Not supported
H14a	QE	→	PU	1	0.303	0.582	–0.017	Not supported
H14b	QE	→	PE	1	0.017	0.895	–0.017	Not supported
H14c	QE	→	WS	1	0.428	0.321	–0.005	Not supported
All constraint				9	26.681	0.005*	–0.128	

Note 1. CMIN: chi-square value and TLI: Tucker–Lewis index.
Note 2. * Significant at $p < 0.1$, ** significant at $p < 0.05$, and *** significant at $p < 0.01$.

significant difference between models 1 and 2 as well. This was acceptable since it would be transformed into a causal relationship corresponding to the hypothesis in the multigroup structural analysis stage. Also, there was a significant difference between models 1 and 4 because the analysis included the result of the covariance constraint in model 2. The result of the factorial invariance test allowed us to proceed with a statistical test of the structural weight differences between the two groups. Before testing the path difference, we conducted the causal relationship test among constructs.

As shown in Table 4 and Fig. 4, supports were found for all the hypotheses in the two groups, except for the path coefficient containing QE and the path coefficient between PE and WS. Meanwhile, the path coefficient between IA and WS and between PU and WS appeared significant only in the IPTV group. Five hypotheses (H1, H2, and H4–H6) were supported, four (H4, H8, H9, and H11) were not, and two (H8 and H10) were partially supported with a 5% significance level (see Table 4). Subsequently, to examine significant differences of path coefficients between the two groups, we performed structural model analysis using cross-group equality constraints and compared the baseline model with path coefficient constraint models. The results suggested that structural weights were equivalent for QE but not for MR and IA. The two path coefficients, IA-PB and IA-WS, were shown to have a bigger influence in the IPTV group. However, the path difference between MR and PU suggested that MR had a higher structural weight for DCTV than IPTV, against our hypothesis.

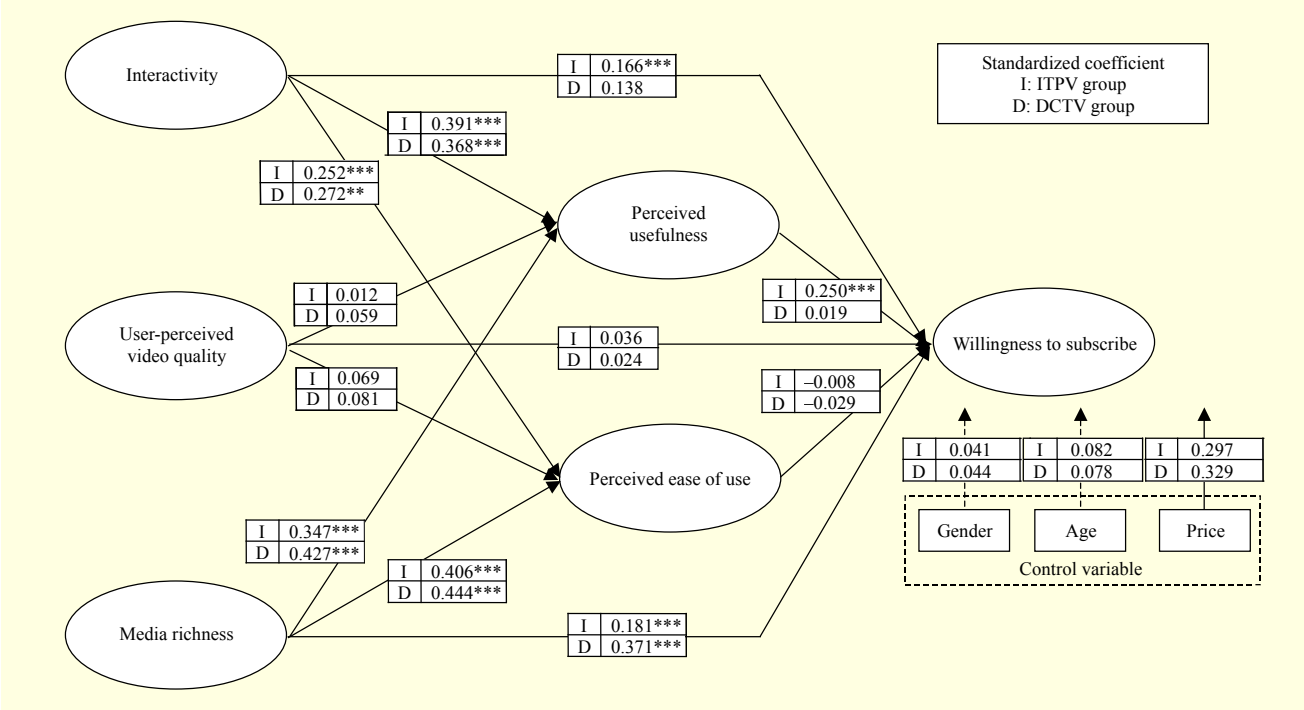

Fig. 4. SEM analysis of research model.

Overall, two hypotheses (H12a and H12c) were supported, six (H12b, and H13b–H14c) were not, and one (H13a) was refuted with 5% significance from the multigroup structural model analysis (see Table 5).

V. Discussion

First, we researched how the unique characteristics of new media, including IPTV and DCTV, influence the willingness to subscribe to either service. We determined that both interactivity and media richness have a direct influence on the acceptance aptitude and intention, but QE as a system characteristic does not. Herzberg's two-factor theory could give a possible explanation for this. Herzberg found that some factors are consistently related to job satisfaction (motivation factors), while others are related to job dissatisfaction (hygiene factors). The latter is significant enough to lead to dissatisfaction but not sufficient enough to lead to job satisfaction [40]–[41]. Zhang classified technical aspects of websites (such as system loading time and availability) as the most salient hygiene factors [42]–[43]. Yang also examined information system quality as a hygiene factor for customer satisfaction [44]. For example, in Rep. of Korea, the quality of IPTV images has made remarkable progress, not only by private/public investment in IPTV infrastructure, but also by standard establishment and continuous video quality monitoring by the government sector [45]. In this situation, video quality as a system quality prevents user dissatisfaction with a new media service but makes no further contribution to the formation of users' attitudes once the users' requirements are met to a certain degree.

Second, we researched how users' attitudes (perceived usefulness and ease of use) influence the willingness to subscribe to either IPTV or DCTV. Perceived usefulness significantly affected the willingness to subscribe in the IPTV group, while perceived ease of use was not significant for both groups. This means that a user would not adopt a new medium even though he or she perceives it as convenient and easy to use. Some studies have proved that perceived ease of use has a direct influence on actual use. However, in the technology acceptance model, perceived ease of use has a direct influence on perceived usefulness, which, in turn, affects the intention to use. Consequently, we found that perceived usefulness is a very important factor for adopting new media. Although using new technology may be complex and difficult, the potential for its adoption is high if it is considered useful. So, to diffuse new media services (especially IPTV), it is more important to emphasize their usefulness rather than technological advances or convenience.

Third, we analyzed whether the factors affecting willingness to subscribe differ significantly between various media. DCTV was believed to be superior to IPTV in user-perceived video quality, but there was no significant difference between the two groups. Many people believed that IPTV interactivity and

media richness capability were superior to DCTV. However, our study showed somewhat different results. The path coefficient from MR to PU was more effective in the DCTV group. From a technological perspective, SDV technology enables an existing cable STB to transmit an infinite number of broadcasting channels. Accordingly, in both the United States and Rep. of Korea, DCTV businesses compete with IPTV providers for a number of channels with the help of new technologies [25]. From the marketing perspective, MR has been advertised as the strongest merit of DCTV since its introduction in the market. Therefore, DCTV subscribers are well aware of MR from the beginning of their subscription, so it was associated with a stronger reaction in the DCTV group. As a result, there was a weak indication that users will substitute IPTV for the existing DCTV. The reason is that they are already locked in with existing media. Also, although IPTV itself does not lack any particular advantage, the advantage of IPTV as a new medium is not strong enough to substitute existing media. Therefore, to spread IPTV, implementing a strategy for most of the general audience accustomed to terrestrial TV would be more efficient than promoting to users subscribing to DCTV. Moreover, the IPTV business should seek a new profit model with a differentiated service that only IPTV can provide. For example, it is easy to implement Internet phone, home appliance control, and electronic commerce, as well as VoD using IPTV. A personalization service, such as "point to point", and a personalized TV portal are also possible. In addition, a high-speed Internet bundle service could provide TPS, TV electronic government, T-commerce, and a home network. These services would certainly attract consumers.

VI. Conclusion

In this research, we defined new media characteristics and then set up a research model to explain the causal relationship between those characteristics, user attitude (perceived usefulness and ease of use) and willingness to subscribe. Also, the path differences between the IPTV and DCTV groups and implications from the analysis results were verified and explained. Unlike traditional research on IPTV adoption only from the diffusion perspective, this research was performed from the competition perspective according to new media–adoption studies. At this point, this paper could help provide a balanced perspective on these studies.

This research had several limitations due to the limited research environment. The survey results may be different from general user-behavior patterns in the media environment, because the survey was performed in the growth period of IPTV in the market, while the number of subscribers, service channels, and characteristics are continuously changing. Also, most of the participants lived in cities, which could introduce bias. Different results would be obtained in rural areas, where high-speed Internet is not prevalent. Hence, future research should gather a wider sample, considering regional differences, and examine and evaluate the participants' recognition of IPTV adoption.

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