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Adoption of Mobile Devices Related to Mobile Service: Tablet PC and Mobile Internet

Sungbum Kim

Faculty, Ph.D. (Innovation and Technology Management), Department of IT convergence, Kumoh National Institute of Technology, Gumi, Gyeongbuk, Korea

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ABSTRACT

The differentiation of products and services determines company's survival in the mobile communication industry. Mobile devices and mobile services now have a close relationship in the new product development process. We attempted to draw an integrated strategy through research related to product and service. In this study, we selected tablet PC as a mobile device and mobile Internet as a mobile service. We explored relevant variables when to plan tablet devices related to use of mobile service and found other variables as a mediator. The mediator is considered as a proxy variable that indicates the direction of the company's product strategy. We employed intention to use as a dependent variable from IDT, TAM and concentrates on two specific aspects as a dependent variable for information and entertainment. We considered relative advantage related to contents/display and compatibility as independent variables. Image and company's reputation was considered as a mediator to relative advantage and compatibility on intention to use tablet devices. We constructed a structural model, verified the model fit, and tested the hypothesis. Such structure was proven to be a statistically significant fit. From this, it can be concluded that in the managerial perspective, when planning and developing tablet devices, the accessibility and usability of the tablet contents and the innovative image of the function and specification of the tablet's display should be considered. The relative advantage of tablet device contents largely contributes to the company's reputation. Company's reputation is a more appropriate variable for information devices than entertainment ones. Finally, the intention to use a tablet for information on the Internet had a statistically significant effect on the intention to use tablet for entertainment. This can be seen as a utilitarian usage influencing a hedonic variable. Studies on product innovation must have a close relationship with service innovation. Product innovation research must include related service variables and service innovation research must include variables related to the product.

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INTRODUCTION

This research uses the mobile communication industry as its main research target domain. In mobile communication industry, end users use mobile communication-related voice or data service through mobile devices and networks. There exist device manufacturers who develop and produce devices for these services, network equipment vendors who develop and install networks, and mobile network operators (MNO) who purchase equipment through their own investments and install network infrastructures, and provide services in this industry. Breaking down the players even more, there are companies that develop and produce the main chips of mobile devices, companies that develop mobile platforms such as operating systems, and recently, there are companies that develop contents and services on top of these platforms and provide to end users. End users are mainly influenced by quality of device and service. End users want the mobile device to have a variety of high quality multimedia functions. Therefore, functions of other non-mobile devices started to integrate with the mobile device, while large display and high quality contents became necessary as well.

If we look into the mobile phone market from 2000 to the present, we can see that the mobile phone industry has consistently been increasing the display size. In the history of the mobile phone industry, the mobile phone display size constantly increased from bar type phones, to the folder type phones, to the slide type phones, and finally to display only phones (DOP). Recently, we have seen the competition between mobile phone manufacturers in differentiating their display size and quality. This can

Corresponding Author: Sungbum Kim, Faculty, Ph.D. (Innovation and Technology Management), Department of IT convergence, Kumoh National Institute of Technology, Gumi, Gyeongbuk, Korea

be seen through the transformation from the 2.0 inch mobile phone to the 3.5 inch iPhone, to the 4.3 inch smart phone, and again to the 5.3 inch smart phone. If we define the boundaries between devices depending on the display size, the minimum display size for laptops will be 10 inches, while tablet PC ranges between 7 to 10 inches, and mobile phones from 1.6 to 5.3 inches. The sub-segment of the mobile phone industry based on LCD size and high quality contents shows the necessity of detailed customer segmentation in new product development.

The mobile communication industry from 2000 to 2007 was concentrated on the mobile phone devices itself. However, as the Apple's iPhone was introduced to the market, mobile services centered on mobile Internet became a big trend. Before, there was a mobile Internet called i-mode, made by NTT DoCoMo. While the development of the i-mode was concentrated on the mobile network operator (MNO), the current mobile Internet focuses not only on MNOs but also on the vendors that develop mobile Internet devices and the companies that develop various applications and contents used on the mobile Internet. Diversification of the mobile service based on the mobile Internet and the amalgamation between services based on mobile Internet are in progress as well. As the services on the mobile Internet become diverse and combined, there are many efforts to develop the most effective device for the service. The various display size of the mobile devices that vary from 3 to 5 inches and even 10-inch tablets, show the struggle in the market to find the best device for using the mobile Internet. Therefore, for diversifying and combining the services on the mobile Internet, the device developers must consider the qualities and features of the mobile Internet service that will be used by the device when planning and commercializing the device. On the other hand, in developing a mobile service, the existence and quality of a device that can run the service is a major factor to consider. Like this, mobile devices and mobile services now have a close relationship in the new product development process.

In this study, we select tablet PC as a mobile device (Derting, 2008; Le Ber, 2008) and mobile Internet as a mobile service (Kim, 2012). We explore relevant variables when to plan tablet devices related to use of mobile service and test the structural model and hypotheses.

Research model and Hypotheses:

We use innovation diffusion theory (IDT) (Teng, 2010; Teo, 2003; Venkatesh, 2003) TAM (Bruner Ii 2005; Davis, 1985), purchase intention model (Jeong, 2009; Warshaw, 1980) and trust model (Flavián, 2006). Through this, we identify and validate the factors that influence the intention to use tablet. We employ relative advantage and compatibility, and image from the IDT (Moore, 1991; Rogers, 2003) and the company's reputation variable from the trust model (Flavián, 2006; Ganesan, 1994) as independent variables. We try to category relative advantage into contents related relative advantage and hardware display related to advantage. This idea is taken from the UTAUT model. We attempt to verify this categorization through the preliminary field study. Mobile communication experts suggested measurement items to categorize into two relative advantages; (i) Contents related relative advantage (frequent updates to keep things current, access to a large selection of applications, easily to download contents) , (ii) hardware, especially display, related advantage : display size, camera and video link, display resolution, web cam/ face tracking). Through the preliminary field study, we verified that end users were possible to distinguish a perceived relative advantage categorized into hardware display related advantage and contents related advantage (Kim, 2015). What are independent variables and what are variables as mediators may have an important implication in the managerial perspective. We explore what variable could act as a mediator between the independent variables and dependent variables. In view of mediator, we have research questions as follows: (i) wouldn't there be a variable that acts as a mediating role in the middle? (ii) Also, would such construct be statistically significant?

The company's reputation and image are employed and tested in the research model as a mediator. Diffusion of new product is determined by consumers' adoption, and we assume that consumers' adoption would be affected by company's reputation (Brown, 2008; Kim, 2012) and image.

We employ intention to use as a dependent variable from IDT, TAM. Given that use of device is related to use of service and that use of service is related to device needed for it, it is emphasized on that both device and service should be included as variables in studies. Consumers have many different uses for tablet devices such as gaming, entertainment, and task. This study concentrates on two specific aspects as a dependent variable for information (Harrison McKnight, 2002; Jarvenpaa, 1999) and entertainment. That will help in planning and managing product and service through its precise implication.

We select variables and construct relevant model based on that both device and service. We suggest a more general structural construct based on the relationship between variables in exploring the use of tablet. This study is to explore the structure between independent variables and to test the structure showed positive effects toward dependent variables. This study, basically, approaches the attitudes based on the end user perception towards products and services.

To explore the relationships between the intention to use a tablet for information and intention to use a tablet for entertainment, we concentrate on

what purpose end users have first and sequence of utilitarian value and hedonic value using a tablet device. In using the mobile Internet with a mobile device, if we consider the mobile Internet tariff and network environments, the diffusion speed of information search was faster than that of entertainment in Europe four countries (Kim, 2012). When fun functions as an independent variable in TAM context, it had a statistically meaningful positive effect. Nonetheless, in the relationship between dependent variables, since the experience of information is sequentially faster than that of entertainment, we employ the hypothesis that the intention to use tablet for information (utilitarian consumption) has a statistically significant positive effect on the intention to use tablet for entertainment (hedonic consumption). The hypotheses were suggested as the following. Relative advantage related to contents is statistically significant and has a positive effect towards image (H1) and company's reputation (H2), while relative advantage related to display is statistically significant and has a positive effect only towards the image (H3). The compatibility only has a positive effect toward company's reputation (H4). In addition, image and company's reputation functions as a mediating variable. While company's reputation has a positive effect on both intention to use tablet for information (H6) and intention to use tablet for entertainment on the Internet (H7). Image only has an effect on the intention to use tablet for entertainment (H5). Finally, the intention to use tablet for information has a statistically significant positive effect on the intention to use tablet for entertainment (H8).

We expect that such research and analysis will differentiate the device and also suggest a direction in establishing the company's product strategy, especially in the case of products that are at its early stage like tablet devices. For a successful market positioning of a device, the company's direction should have a synergism with each product strategy.

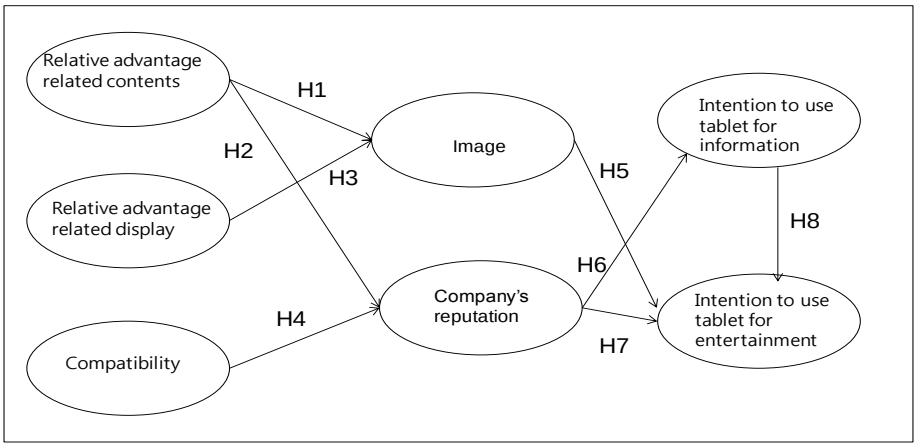

Fig. 1: Research Model.

Table 1: Hypotheses.

Hypotheses	Details
H1	Relative advantage related to contents is positively associated with the image.
H2	Relative advantage related to contents is positively associated with the company's reputation.
H3	Relative advantage related to display is positively associated with the image.
H4	Compatibility is positively associated with the company reputation.
H5	Image is positively associated with the intention to use tablet for entertainment.
H6	Company's reputation is positively associated with the intention to use tablet for information.
H7	Company's reputation is positively associated with the intention to use tablet for entertainment.
H8	The intention to use tablet for information is positively associated with the intention to use tablet for entertainment.

Methods:

The preliminary field study attempted to answer two questions: (1) Is it possible for end users of tablet devices to distinguish between display-related advantage and contents-related advantage? (2) If so, how do they distinguish the two? To do so, we conducted interviews with mobile communication experts (product planner and product development engineer) on how end users distinguish between the relative advantages related to hardware display and the contents. We interviewed six people (2 product planners, 2 software developers, and 2 hardware developers), and we were able to derive variables (relative advantage related to contents and hardware display) as mentioned before (Research model and hypotheses).

The research model included seven factors. Each factor was measured in multiple items. All measurement items were organized through existing literature. The idea of classifying relative advantage into the content category and the hardware display category was from the existing literature (Laukkanen,

2005; Tan, 2010). The actual classification was completed through a professional pre-study and verified through pilot study. Through this, content validity is ensured (Boudreau, 2001). The reliability and validity of the variables were secured as explained as followings (Table 2).

This research was performed using structural equation modeling. This analysis was performed through two step approach (Anderson, 1988). Firstly, we constituted a measurement model and tested the reliability and validity. Then, we constructed a structural model, verified the model fit, and tested the hypothesis.

We carried out online survey and collected data. The survey aimed to analyze respondents' attitudes toward product. The variables were measured with Likert-type scale for all model components. Out of 1,200 end users, 310 took part in the survey, and the response rate was 25.8%. The gender distribution of the study was 50.3% males and 49.7% females, respectively. Respondents between the ages of 20-29 formed the largest age group (38.1%) followed by the 30-39 –year olds (35.4%). The average age of the respondents was 34.7 years.

Results:

4.1 Measures and validation:

For validation, statistics index was satisfied such as Cronbach's alpha, factor loadings, construct composite reliabilities, and average variance extracted (AVE). The internal consistency reliabilities of the summated scale variables were tested with Cronbach's Alpha coefficient. The reliability value was not below .70 and that each construct demonstrated internal consistency. AVE was validated for construct validity, and it was greater than the recommended value by .50. We compared the square root of the AVEs with the correlations in each construct and the largest correlation value was less than the square root of AVE. These results showed that each construct provided evidence of discriminant validity (Kim, 2015).

4.2 Measurement and Structural model fit:

GFI, AGFI, NFI, TLI, CFI satisfied the recommended value of both the measurement model and the structural model. Residual indices like SRMR and RMSEA were both less than 0.05 and therefore satisfied the standard. Thus, the overall fit of the model was satisfied.

Table 2: Construct, Cronbach's Alpha, Factor loadings, Composite reliability and AVE : Consumer attitudes toward Tablet PC.

Construct	Number of items	Cronbach's Alpha	Factor loadings	Composite reliability	AVE
Relative advantage_ contents	3	.81	.88, .84, .83	.89	.73
Relative advantage _Display	4	.87	.88, .83, .84, .85	.91	.73
Compatibility	3	.86	.90, .89, .87	.92	.79
Image	4	.83	.75, .85, .82, .86	.89	.66
Company's reputation	2	.83	.93, .92	.92	.85

Table 3: Fit indices of the research model.

	GFI	AGFI	RMSEA	SRMR	NFI	CFI	TLI
Measurement model	.920	.892	.047	.033	.941	.975	.969
Structural model	.912	.888	.049	.041	.936	.972	.967
Recommend value	>.90	>.80	<.05	< .05	>.90	>.90	>.90

4.3 Path Coefficients:

The associated t values of the coefficients revealed the statistical significance and all hypotheses except for H7 were supported. The relative advantage related to contents (R_contents) and relative advantage related to display (R_display) have significant effects on the image. Between them, R_contents have the largest effect on the image. (ß=.64) This means that the relative advantage in accessing contents when the end user is using the tablet device has a positive effect on the perception that the user can look technology savvy and innovative to others. In addition, R_contents and compatibility have significant effects on the company's reputation. This means that there is an increased expectation on the corresponding company's reputation as the people perceive that by using the contents of the tablet, the user's job will be enhanced and the quality of the job will be improved. In addition, the more the tablet is compatible with my work style, the higher the expectations are on the competency and honesty of the company that developed and manufactured the tablet device. Since the image has an influence on the intention to use a tablet, it has a significant effect on the intention to use a tablet for entertainment on the Internet. Though the company's reputation has a statistically significant effect on the intention to use a tablet for information on the Internet, it does not have a significant effect on the intention to use it for entertainment. Finally, intention to use a tablet for information has a positive effect on the intention to use a tablet for entertainment

Table 4: The results of hypotheses test.

	Effect	Coefficients	S.E.	Sig.	Support
H1	R_contents→ Image	.643	.084	***	Yes
H2	R_contents→Company's reputation	.565	.082	***	Yes
H3	R_display→ Image	.119	.057	.037**	Yes
H4	Compatibility→Company's reputation	.339	.070	***	Yes
H5	Image→ intention to use tablet for entertainment	.079	.031	.011**	Yes
H6	Company's reputation →intention to use tablet for information	.131	.033	***	Yes
H7	Company's reputation→ intention to use tablet for entertainment	-.043	.025	.091	No
H8	The intention to use tablet for information→ The intention to use tablet for entertainment	1.024	.045	***	Yes

** p< .05; *** p<.001,

Discussion and Conclusion:

We categorized relative advantage into contents related and hardware display related. It was concluded that the separation of the tablet device's relative advantage was appropriate for drawing the conclusion of managerial implication.

Moreover, the content validity of such an idea was secured through the pre-study of professionals. Secondly, this research suggested a structure not by constructing a model that all of relative advantage and compatibility, image, and company's reputation (Sirdeshmukh, 2002) have a direct effect on, but by supposing that image and company's reputation have a mediating role to relative advantage and compatibility on intention to use tablet devices. Finally, such structure was proven to be a statistically significant fit.

It is as the following if we examine the variables that have a statistically significant value regarding structure. Firstly, image means that the end user perceives how the public thinks of the user when the end user is using the product or service. In this study, we measured it based on how the end user felt IT savvy, trendy, and luxurious to the public by using a tablet. The relative advantage perceived by the end user on both the contents of the tablet and the display showed a positive effect on image. From this, it can be concluded that in the managerial perspective, when planning and developing tablet devices, the accessibility and usability of the tablet contents and the innovative image of the function and specification of the tablet's display should be considered. In addition, since the image had a statistically significant positive effect on the intention to use tablet for entertainment on the Internet, the developers of tablet devices with entertainment usage should plan and develop the device while keeping this in mind. It is known that the display specification of the iPad3 will be improved from that of the iPad1. It was improved from 768*1024 pixels with ~132 ppi pixel density to 1536*2048 pixels with ~264 ppi pixel density. The improvement in the functions and specification of the i-Pad's display substantiates the previously mentioned idea. Company's reputation, the second parameter, is the end users' perception that the company is competent and honest. In this study, the relative advantage related to contents and compatibility had a statistically significant effect on company's reputation. Especially, the perceived relative advantage of the tablet contents had relatively high coefficients. This shows that the relative advantage of tablet device contents largely contributes to the company's reputation. Thirdly, while the effect of the company's reputation to the intention to use a tablet showed a statistically significant value when the intention to use a tablet was for information, it did not have a statistically significant value when the intention to use a tablet was for entertainment. This implies that the trust on a company is a more appropriate variable for information devices than entertainment ones. Finally, the intention to use a tablet for information on the Internet had a statistically significant effect on the intention to use tablet for entertainment. This can be seen as a utilitarian usage influencing a hedonic variable.

The image and company's reputation used in this study can be said to have acted as a mediator in terms of a research model and considered as a proxy variable that indicated the direction of the company's product strategy as mentioned in the beginning. The image suggests that tablet device developers should design a product that the end user can perceive himself as an innovative person to the public by using the tablet device. In addition, the notion that company's reputation can influence the intention to use a product shows that the company's reputation can have a synergy effect with the competitiveness of the product.

Studies on future product innovation must have a close relationship with service innovation. Product innovation research must include related service variables and service innovation research must include variables related to the product in a narrow sense. Especially, in the mobile communication industry that includes the mobile device manufacturer and mobile network operator, the

consideration of both the mobile device and mobile service is important when planning and developing the product. In our study, we suggest an integrated framework that approaches the product innovation and service innovation of the mobile product and service through empirical study.

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