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Analysis of Tablet Device usage for Mobile Internet with Segmentation Approach

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ABSTRACT

When a new product is introduced in the market, some consumers adopt it quickly, while others wait before using it. Product managers should classify end users and explore the characteristics of consumers according to each consumer's segment. The objective of this paper is to investigate the use of a tablet device for accessing information on the mobile Internet. The study first analyses variables such as consumer perceptions and attitudes toward tablet devices through expert interviews and factor analysis. Then, it classifies consumers into categories according to their perceptions and attitudes toward tablet devices using latent class regression methodology. The final section of the paper tests the statistical significance of a set of variables related to tablet characteristics such as the relative advantage related to contents and tablet display, compatibility with consumers' prior experiences and needs, image, and company's reputation. The results validate that end users are classified into three segments and factors elicited have significant effects on the use of tablet devices. The five factors are significant in indicating differences across segments, whereas four indicators excluding compatibility are significant in terms of the amount of variables' sensitivity. Segment 1 could be labeled "Product oriented segment"; segment 2, "Company's reputation with contents advantage oriented segment"; and segment 3, the "Innovative image with tablet display advantage oriented segment. These results have implications for product managers wanting to classify end users and determine the optimal variables in developing innovative products.

Keywords: tablet, segments, latent class regression, relative advantage, image, compatibility, company's reputation

INTRODUCTION

As mobile devices have recently expanded from mobile phones to tablet devices in the mobile communication industry, end users expect a wide range of options, from the 3-inch mobile phone to the 10-inch tablet device. On the other hand, companies now face the challenges of planning and developing a tablet device to satisfy consumer needs and to respond to competition. In the past, end users regarded the function, industrial design, and price of mobile device as key buying factors, whereas in recent years, consumers have begun emphasizing the accessibility to applications and contents permitted by echo-system including operating system. End users download contents and applications frequently; therefore, accessibility and ease of use have become determinants of customer adoption of tablet devices.

On reviewing the previous literature on tablet devices, we find that the technology acceptance model (TAM) was used in adoption research. Brunner and Kumar (2005) focused on handheld devices and used a TAM to determine the user acceptance of PDAs, wireless devices, and PCs. Derting and Cox (2008) found that the use of tablet PCs in education enhanced students' enthusiasm to learn, and LeBer et al. (2008) identified that tablet PC is an innovating teaching tool in health science education. However, it is difficult to find literature that distinguishes consumer responses to different attributes of tablet devices. Recently, in the context of human–computer interaction, Kallinen et al. (2011) explored the moderating effect of content type and presentation style on end users' experience of tablet PCs. This study, therefore, is meaningful in that it distinguished consumer responses to different content types of tablet PCs.

Our study explores how an end user's intention to use is affected by perceived relative advantage, which is further dichotomized into perceived relative advantage because of hardware display and that because of contents. Furthermore, this study examines how consumers' perceived innovativeness of a product and perceived trust in the company affect intention to use. The former is captured by a "image" variable, based on innovation diffusion

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theory, and the latter by a "company's reputation" variable. In addition, this study considers the relationships among the following variables: perceived relative advantage because of hardware display and contents, image, and perceived company's reputation.

In developing the research framework that best suits the objectives above, the following aspects were considered. Many new tablet devices are entering the market, and it is more appropriate to identify specific segments and explore variables by each segment, rather than find variables according to aggregated end users. However, the current literature does not elaborate on new product development strategy pertaining to these segments.

By segmenting the end users, it would be possible to deduce practical managerial implications [24] and contribute to the literature on tablet device user study. This study will classify and explore by segment the factors that affect end user's intention to use. Mobile communication firms will thus be able to derive implications from the findings to maintain their competitiveness by continuously developing and introducing new products and services.

Literature review:

Research framework:

We employed intention to use/purchase as a dependent variable and used the Innovation Diffusion Theory (IDT) [19], technology adoption model (TAM) [5], and purchase intention model [11, 23] as our theoretical framework. The IDT categorized main attributes into relative advantage, ease of use, compatibility, observability, and trialability [19], whereas TAM employed ease of use and usability as the main variables. On the other hand, the purchase intention model employed motivational and non-motivational factors as the main variables where the former corresponds to perceived need and the latter corresponds to purchasability, which is determined by affordability and accessibility.

This research employed intention to use as a dependent variable and selected different variables from IDT, TAM, and the purchase intention model as independent variables. From IDT, the framework employed relative advantage – further categorized into due to contents and hardware display – and compatibility. Ease of use was not included as independent variable separately. Because it was considered while assessing relative advantage related to contents. In addition to the three variables above, company's reputation and image were employed in the research model. Diffusion of new product was determined by consumers' adoption, and we assumed that consumers' adoption would be affected by company's reputation [2, 13] and image.

The research framework also focused on intention to use the tablet for accessing information on the mobile Internet, which meant that tablet devices were used as a mobile Internet device. This is because a tablet device has many different uses – including gaming, entertainment, and office tasks – and focusing on one specific aspect will help in deducing its precise managerial implication. This is important and must be addressed further in future studies. According to the context of use and contents characteristics, intention to use may differ. Since many of digital devices released later, especially mobile devices that have various functions of other digital devices, the approach that it is just overall intent to use device cannot give a meaningful help to product development manager in the real field. There are concerns that the product might be developed without knowing the end users' purpose toward devices.

Relative advantage:

Relative advantage is employed in Roger's innovation diffusion theory. The use of C-TAM, a revised version of TAM, has expanded from the adoption of a new IT system in organizations to that in the consumer markets. However, TAM was devised to analyze the adoption of a new IT system in an organization. IDT is more suitable for analyzing adoption in the consumer market. This study employs IDT as the main framework and relative advantage as the independent variable [18]. Relative advantage can be defined as the degree to which adopting innovation is perceived as being better than using its precursor [18, 19]. The relative advantage variable focuses on the mobile Internet use by end users of tablet devices. The mobile Internet use by tablet users was compared to that by mobile phone and notebook users [21] from the perspective use of contents and preference of device's display. This study divided relative advantage into two categories based on an expert pre-study: one related to contents and its counterpart related to tablet display. The rationale behind the categorization is that a tablet device is positioned as a mobile Internet device and it is inappropriate to treat it as a conventional PMP, PDA, or WAP-enabled phone. Therefore, application, adoption from the mobile Internet contents should be distinguished from that of the hardware functions especially. In addition, selection of the tablet display as an independent variable is based on the hypothesis that competitiveness in tablet display will determine the competitiveness of a tablet from the hardware perspective [15]. We, therefore, propose the following hypotheses.

H1a: Relative advantage related to contents has a positive effect on the intention to use a tablet device for accessing information on the mobile Internet.

H1b: Relative advantage related to tablet display has a positive effect on the intention to use a tablet device for accessing information on the mobile Internet.

Compatibility:

Compatibility is defined as the degree to which the innovation is consistent with the potential adopter's existing values, previous experiences, and needs [18, 19]. Compatibility attempts to measure the fitness of a tablet for: (1) a person accessing the Internet frequently; (2) a mobile user with a busy lifestyle; and (3) the previous experiences of a person who accessed the Internet via a notebook.

In the product manger's point of view, the compatibility variable has its significance in achieving implications of product planning through comparing other mobile Internet devices like notebooks, netbooks, e-book readers, smartphones, etc.

This study explores how such compatibility affects the adoption of the tablet. Ultimately, this study attempts to identify how a tablet fits in with the experience or current needs for mobile phone or notebook, and, therefore, we propose the following hypothesis:

H2: Compatibility has a positive effect on the intention to use a tablet device for accessing information on the mobile Internet.

Image:

The definition of image employed in this study is based on that of Rogers' framework. In this case, image is defined as the degree to which the use of an innovation is perceived to enhance one's image or status in one's social system [18, 19]. Image of a product is defined to be the extent of the perceived improvement of an end user's image when he/she uses the product (i.e. using a tablet makes the user appear IT savvy, affluent and trendy). Since a tablet is more of a lifestyle product than a necessity product, image is an important independent variable [21]. We propose the following hypothesis:

H3: Image has a positive effect on the intention to use a tablet device for accessing information on the mobile Internet.

Company's reputation:

The concept of trust and company's reputation has gained attention in the marketing literature because it enables the establishment of a sustainable and profitable relationship [7, 8, 20]. The importance of these concepts is emphasized for Internet research, in particular, and it is rational to adopt the variable in this study, which assumes that a tablet device is used to access information on the mobile Internet [9, 10]. Especially for a new company entering a new industry, consumers' trust is a very important determinant of product adoption. Koufaris and Hampton-Sosa (2004) explore the statistical significance of independent variables that affect trust in a company. Some studies employ company's reputation as a determinant of consumers' initial trust in the company and integrate TAM in their model [13]. In this study, we explore how company's reputation, as one of the constructs of trust, affects tablet device use.

H4: Company's reputation has a positive effect on intention to use a tablet device for accessing information on the mobile Internet.

Methods:

Preliminary field work for variables and study design:

The preliminary field study attempts to answer two questions: (1) Is it possible for end users of tablet devices to distinguish a perceived relative advantage and categorize it into HW-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 the relative advantages related to hardware and the contents of product devices. 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) as shown in the table below.

To summarize, this study focuses on variables such as relative advantage related to tablet device, compatibility with consumers' prior experiences and needs, company's reputation, and image. The relative advantage, furthermore, is dichotomized into relative advantage related to display and its counterpart related to contents.

Data collection:

We collected the data through an online survey in South Korea. The survey aimed to analyze respondents' attitudes, and they were asked to evaluate perceived relative advantages in terms of tablet display and contents- related functions separately. We measured the responses on a Likert-type scale. We collected 310 usable responses from 1,200 samples, and the response rate was 25.8%.

Latent class regression:

We used latent class regression (LCR) to assess the relationships among variables related to tablet use, and we found unobserved end user heterogeneity [24]. By using latent class regression, we classified each segment and estimated the regression model for each segment. LCR is a useful and flexible methodology that can be used regardless of the types of dependent and independent variables (i.e. whether they are nominal or of mixed type does not matter) [22]. Latent class analysis, unlike other methodologies, determines the optimal number of classes on the basis of statistical models and identifies the class on the basis of the probabilities of being grouped into each class [25]. For analysis involving both categorical and numerical variables, K-means is limited, whereas latent class can analyze variables using different scales [4]. We used Latent

Gold 4.5 for LCR and focused on the different effects of the five variables on tablet device use. The direction, magnitude, and statistical significance of the coefficients of interest for end users in different segments may differ. The different segments are the results of the inherent heterogeneity among end users.

Table 1: Contents and tablet display measurement.

Categories	Measurement Items
Contents	Frequent updates to keep things current
	Access to a large selection of applications
	Easily to download contents
Display as hardware	Display size
	Camera and video link
	Display resolution
	Web cam/ Face tracking

Results:

Respondent profile and construct validation:

The average age of the respondents was 34.7 years and 50% of the respondents were male (See table 2). The majority of the respondents were in their 20's and 30's (74%). We conducted factor analysis and calculated factor loadings, construct composite reliabilities, and average variance extracted (AVE) statistics. The results showed the reliability value is greater than .70 and that each construct demonstrates internal consistency. AVE was validated for construct validity, and it is 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 is less than the square root of AVE. We found through these results that each construct provided evidence of discriminant validity.

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Model selection:

We used Bayesian Information Criterion (BIC), Akaike Information Criterion (AIC), and the likelihood ratio chi-square statistic (L2) as measures to decide on the number of classes. These measures are useful for selecting different models in LCR analysis. The information from these measures, based on "model fit and parsimony", allows for comparison among different models [17]. Although recent studies suggest that BIC is the most useful measure [1, 22]. We included all the measures – (BIC), AIC, L2, and R2 – in the study. Class-3 exhibits the lowest value of AIC, while Class-4 exhibits the lowest in L2 and Class-1 BIC. Considering these results and R2, we selected class-3[25].

The R2 increases from .56 for the 2-class model to .82 for the 3-class regression model. We identified three latent classes in terms of determinants of tablet use and explored the differences in end users' characteristics among the three segments.

Table 2: Demographic profile.

		Age					
		10's	20's	30's	40's	50~	Total
Sex	Male	1	71	51	24	9	156
	Female	1	47	59	35	12	154
	Total	2	118	110	59	21	310

Table 3: Measures and validation

Construct/measures	Cronbach's α	Factor loadings	Composite reliability	AVE
Relative advantage_ contents	.81		.89	.73
RAC1		.88		
RAC2		.84		
RAC3		.83		
Relative advantage _Display	.87		.91	.73
RAD_1		.88		
RAD_2		.83		
RAD_3		.84		
RAD_4		.85		
Compatibility	.86		.92	.79
C_1		.90		
C_2		.89		
C_3		.87		
Image	.83		.89	.66
I_1		.72		
I_2		.85		
I_3		.82		
I_4		.86		
Company's reputation	.83		.92	.85
CR_1		.93		

CR_2		.92		

Table 4: Latent variable correlation.

Variables	(1)	(2)	(3)	(4)	(5)
Relative advantage _contents (1)	1.00				
Relative advantage _Display (2)	.56	1.00			
Compatibility (3)	.54	.76	1.00		
Image (4)	.68	.57	.50	1.00	
Company's reputations(5)	.61	.64	.60	.62	1.00

Table 5: Comparison of tested models.

Tested models	BIC(LL)	Npar	AIC	L2	p-value	df	Classification error	R2
1-Class	871.0252	9	837.3961	761.5484	9.7e-42	301	0.0000	0.0678
2-Class	902.4494	19	831.4546	735.6069	2.4e-40	291	0.1308	0.5587
3-Class	936.1553	29	827.7947	711.9470	3.1e-39	281	0.2634	0.8180
4-Class	979.6611	39	833.9348	698.0872	1.9e-39	271	0.3809	0.8776

Analysis of parameters of 3-class model:

In the three segments, segment 1 consists of 35% of the end users, segment 2 contains about 33%, and segment 3 contains 32%. The beta parameter for each predictor measures the influence of the variables on tablet use. The Wald (=) statistics indicates whether indicators have the same effect across the segments and whether their differences are significant across the segments. All Wald (=) statistics show that all indicators are significant in the differences of beta effects across classes. However, the p-value for the Wald statistics indicates that the amount of compatibility sensitivity is not significant.

Relative advantage related to contents and tablet display has an influence on class 1 and is affected by the perceived relative advantage of the product itself. Therefore, segment 1 could be labelled "Product oriented segment". In class 2, the relative advantage related to contents, compatibility, and company's reputation have a strong effect on segment 2 and could be labelled "Company's reputation with contents and compatibility oriented segment". In class 3, the relative advantage related to display and image has a strong effect on class 3 and could be labelled "Image with perceived display advantage oriented segment.

Table 6: Latent class regression Model .

Predictors	Parameters			Wald	p-value	Wald(=)	p-value
	Class1	Class2	Class3				
	(n=109)	(n=102)	(n=99)				
	35%	33%	32%				
Relative advantage related Software	.3737**	.8708**	-1.4660**	18.1753	.00041	10.4300	.0054
Relative advantage related display	.3955**	-1.4267**	2.4718**	18.1470	.00041	12.0773	.0024
Compatibility	-.2382	.6803**	.4977	7.6793	.053	7.6790	.022
Image	.2241	-.8534**	1.7535**	12.7747	.0052	10.7469	.0046
Company reputation	-.0641	.9358**	-2.1854**	10.8499	.013	10.8399	.0044

** p<.05

Hypothesis testing:

We present the results for segments 1, 2 and 3 respectively, through which we tested our hypotheses. The hypothesized positive relationship in H1a was supported in segment1 and segment 2(Segment 1: b = .374, p < .05, segment 2: b=.871, p < .05), but in segment 3, the results showed negative (Segment 3: b = -1.466, p < .05) effects of the end users' ranking of preferences for tablet use for accessing information on the mobile Internet. In testing H1b, the results supported the positive (Segment 1: b =.396, p < .05, Segment 3: b =2.472, p < 0.05) effects of the end users' ranking of preferences for tablet use for accessing information on the mobile Internet. Somewhat, unexpectedly, the coefficient with compatibility is statistically significant in segment 2 only. In H2, the results in segment 2 supported the positive effects of the end users' ranking of preferences for tablet use for accessing information on the mobile Internet. In testing H3, the coefficient with image is not statistically significant in segment1 but significant in segments 2 and 3. The results supported the positive (Segment 3: b =1.754, p < .05) and negative (Segment 2: b = -.853, p < 0.05) effects of the end users' ranking of preferences for tablet use for accessing information on the mobile Internet. Lastly, in testing H4, the coefficient with company's reputation is not statistically significant in segment1 but significant in segments 2 and 3.

The results supported the positive (Segment 2: b =.936, p < .05) and negative (Segment 3: b = -2.185, p < 0.05) effects of the end users' ranking of preferences for tablet use for accessing information on the mobile Internet.

Analysis of adding covariates and classification output:

After segment analysis, we used post-hoc profiling of segments methodology and evaluated the demographic profile. We included a sex variable in the model and re-estimated the regression model [25]. By doing so, we were able to predict probabilities of the classes to be included in the future on the basis of SEX. The p-value associated with the Wald statistics shows that this effect is significant. The betas associated sex=male (-.2347, -.3850, 6197) suggest that males are more likely to belong to the "Innovative image with perceived display advantage segment" (class 3). Female has high probability of being classified in somewhat class 2.

Table 7: Tested of hypotheses.

Hypothesis number	Hypothesis	Supported		
		S1	S2	S3
H1a	Relative advantage related to contents has a positive effect on the intention to use a tablet device for accessing information on the mobile Internet.	Y	Y	N(-)
H1b	Relative advantage related to tablet display has a positive effect on the intention to use a tablet device for accessing information on the mobile Internet.	Y	N(-)	Y
H2	Compatibility has a positive effect on the intention to use a tablet device for accessing information on the mobile Internet.	N	Y	N
H3	Image has a positive effect on the intention to use a tablet device for accessing information on the mobile Internet.	N	N(-)	Y
H4	Company's reputation has a positive effect on intention to use a tablet device for accessing information on the mobile Internet.	N	Y	N(-)

Table 8: Parameters output for covariates.

	Class1	Class 2	Class 3	Wald	P-value
Male	-.2347	-.3850	.6197	6.0224	.049
Female	.2347	.3850	-.6197		

Discussion and conclusion:

Our study describes tablet use in terms of innovation diffusion theory using a latent class regression analysis. A single regression method for aggregated consumers may be inappropriate, and probably misleading, if the observations are collected from a heterogeneous groups of end users. Especially, in the initial stage of new product diffusion, end users have different attitudes toward product characteristics. Therefore, a latent class regression method is selected here to estimate the segment specific coefficients simultaneously. Latent class analysis is not restricted by the type/scale of the variable and can predict the class of new objects, which was not included in regression analysis. We also suggest and indicate some managerial implications for new product development in the mobile communication industry. Product planners of mobile device need to understand the preference of end users in order to develop successful new products. The preferences and attitudes of consumers in different segments are important for new product development and for advertising to particular consumer segments. Rather than satisfying all potential end users, the manager may decide to optimize the product for the selected and most feasible segment. We can select the segment comprising people who have similar characteristics, in other words, similar regression coefficients using latent class regression models. The heterogeneity in the sample is captured by assuming that there are some latent segments in the markets.

The limitation of this study, however, is that sex was the only statistically significant covariate. If sex, age, innovator type, and ownership of the tablet are statistically significant, it will be possible to predict the class of new entities on the basis of their profile. This study would have been able to deduce more implications if additional analysis and tests identified whether a significant construct exists between segment 2 (relative advantage related to contents, compatibility with consumers' prior experiences and needs, and company's reputation) and segment 3 (relative advantage related to display and image). The analysis and test would provide useful implications that could assist the positioning strategy of tablet devices according to different markets and the product development strategy in accordance with the device features and attributes desired by end users.

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Authors' Contribution:

Dr. Sungbum, Kim conceived research framework, designed experiments, analyzed the data and wrote the paper.

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