A Study on the Properties of Mobile Phone that Influence on the Choice of Handset and Telecommunication Company*

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Abstract

Mobile phone-related industries have been mainly concentrated on attracting the new customers and increasing the market share such as for the aggressive marketing activities, but it is the time to find an effective strategy to preserve existing customers since the mobile phone market had already reached the saturation. In this study, the properties of mobile phone that influence on the choice of handset and telecom company were analyzed. General properties of respondents were explored and the mobile phone properties were grouped by common factors. And analyzed the effect of factors on customer satisfaction with structural equation model. 10.4% of respondents are used their handset more than two years and 48.7% wanted to purchase other manufacturer's handset if they repurchase mobile phone. These results might come form the fact that the life cycle of mobile phone become shorter by the heating competition in mobile phone market and ,to some degree, the influence of smart phone which recently become globally popular. Four factors, 'Hardware Quality', 'Practicality', 'Convergence Functions' and 'Level of Awareness', are induced from the mobile phone properties. In Structural Equation Model analysis, 'Hardware Quality' and 'Practicality' have significant and positive effects on Customer Satisfaction. But, 'Awareness' such as brand and trend appeared quite less influence on the customer satisfaction.

Keywords : Mobile Phone, Mobile Market, Customer Satisfaction, SEM

1. Introduction

Industries related to mobile phone have developed rapidly for last 20 years, having progressed as main industry of national economy. And these have led the growth of telecommunication technology. The number

of members of domestic mobile phone was mere under 1.6 million(6.9% penetration rate) up until 1995, though it reached 40 million(80% penetration rate) in 2006, and by the end of November 2009, it accomplished about 96.2%(47,846,236) of our population(49,759,141) [8]. After the year 2000, the mobile phone market raised double-digit growth rate every year. Mobile phone exports in 2009 were reached 28.7 billion dollars which was 23% of total IT exportation(121 billion dollars). Also in 2010, it had been analyzed that about 74% of the total mobile phone demanding is taken by the device replacement demands. The weight of replacement demand shows constant uptrend, 57% in 2003 to 58% in 2005, 60% in 2007,and 67% in 2009, etc.. '2010 Mobile Phone Market Outlook' report disclosed; "It will be expected that based on the global economy recovery, an amplified consumption and the intensified competitions in handset businesses will shorten the period of replacing phones and increase the demand of replacing."[9].

In 2009, mobile phone domestic market in Korea recorded total of 7.14 billion dollars, which ranked the 4th largest after United States, China, and Japan. In 2009, Korea mobile phone market is the 8th largest in the world, with the record of selling 23.67millions of phones. Especially, in 2009, the number of sold 3G phones was over 60% of the total number of phones that were sold. The rest 40% is the 2G or CDMA phones. 51% of the communication network is covered by the SK telecom company, 31% by the KT Company, and 18% by the LG telecom company. The price of domestic phones is average 330 dollars, which is the most expensive out of 82 countries, excluding Japan. The reason why

the average price of them is expensive is because of the management fee and consumer's favor in high quality handsets. Korean market, which has one of the world's highest ASP, has many factors that Smart-phones can rapidly rise and it seems like that market will have rapid growth[2]. At the moment, phones with a variety of designs and functions are released in mobile phone market, and each company is developing the phones considering the consumers favor to maximize the profit. With domestic mobile phone market reached saturation, the companies have been competing to deliver enhanced products and data services to keep growth alive. The property of the mobile phone is taking important role to choose mobile handset and mobile telecom company. In the present situation, exploring and analyzing the important properties of mobile phone are very meaningful study. Therefore, the survey was carried out to get the properties of mobile phone and analyze the influence of the choice of handset and telecom company. And draw the important variables for customer satisfaction which must be given priority.

2. Theoretical Background

Although, the manufacturers have been mainly concentrated on attracting the new customers and increasing the market share such as for the aggressive marketing activities, it is the time to find an effective strategy to preserve existing customers since the mobile phone market had already reached the saturation. The consumer's preference in choosing phone changed much,

which now they select the products based on the quality of its hardware, advertisement, brand image, and its company's general reputations. Assaei(1998) proposed that the consumer's attitudes is a core factor of determining purchase intention which becomes the pre-step of committing the purchase through the rational behavior model. According to him, since the intention is a dcrect factor that determines the purchasing behavior, it is also possible to predict an actual purchasing behavior using purchase intention. Consumer's decision-making occurs in the prediction of their purchase behavior and if in general, the favor in particular product's property increases, it is more likely to form higher desire in purchase, which eventually leads to consumer's behavior[1]. The increasing number of mobile phone users and the expansion of the market had many researches that were studied about mobile phone marketing, and according to the studies, mobile phone marketing research can be distinguished into two different categories: a research of mobile communication service, and the terminal of a mobile phone. As a research of mobile communication service; Kwon and Kim(2000)'s research on the quality of a service and consumer satisfaction[3], Rhee and Rha(2000)'s empirical study on customer satisfaction and service quality in mobile telecommunication service[11], You(2002)'s study of consumer attitude and satisfaction on mobile phone service[14], Oh and Choi(2007)'s research on how the service restoration property affects the telecom-munication consumer satisfaction and loyalty[10], Zu and Lee(2009)'s study on the effects of mobile phone service quality to switching barrier[16], etc. various researches have been done. For the mobile phone handset marketing researches, mobile phone

evaluation criteria study(Lee and Kim, 2001)[6]], handset purchasing effect factor analysis(Lee, 2002)[7], and the effect of consumer characteristics on benefits sought and importance in attributes of durable goods(Kim and Kang, 2005)[5] and other various subjects in this area were researched. Lee and Kim(2001) tried to verify the consumers' evaluation of mobile phone quality and the influencing factor on consumer satisfaction. They inferred three evaluation criteria of mobile phone using factor analysis: 1) External factors of handset(design, color, size, price), 2) Internal factors of handset(performance, call quality, after service, durability), 3) Service factors (various functions, contract, service option, assurance, contract period, charge rate)[6].

Yun and Nam(2004) investigated the using actual condition of mobile phone users by their age. Due to the result of their investigation, youths consider design (color, shape, size) as main factor while middle and elderly people concerns call quality[15]. Kim and Park(2008) applied Kim and Kang(2005)'s research result to mobile phone handset market segmentation. They described market-segment profile after identified the market segments of mobile phone handsets based on the benefits sought, using cluster analysis and explored the differences in buying behaviors[4][5].

3. Research Design and Data Analysis

3.1 Research Design

In this study, from the previous discussed researches, the properties of mobile phone that influence on the choice of handset and telecom company were analyzed. First, the general properties of

respondents were explored. And the mobile phone properties of the respondents were grouped by common factors using factor analysis. The validity and reliability of the model were examined and regression analysis were conducted for the factor scores which came from the results of factor analysis. Also, it was analyzed that the reconstructed latent variables effecting on customer satisfaction with structural equation model.

3.2 Sample collection

Data was collected from the mobile phone users living in Gwangju Metropolitan City, Korea. After verified contents and sentences of questionnaires, preliminary sample survey was conducted to complement the relevance and adequacy of questions with 40 mobile phone users. The survey was conducted from Nov. 27 to Dec. 11 in 2009. Self-administered surveys were distributed to 320 users. After checking sample bias and missing data, this study used a total of 308 questionnaires, which represents a 96% response rate. A summary of the responses and the descriptive statistics are reported in <Table 1>. The questions of importance and customer satisfaction of the mobile phone properties were constructed as not important-important statements on a 7-point Likert scale. In terms of measurement, all properties of mobile phone which from prior research were reconstructed to 15 questions but the questions were refined from the result of screening process and factor analysis to 12 questions. Therefore factor analysis was conducted for 12 properties in <Table 2> and structural equation model was constructed with dependent variable, customer satisfaction, in <Table 3>.

<Table 1> Sample Demographics

variable	scale	frequency	%
gender	male	144	46.8
	female	160	53.2
age	teens	8	2.6
	20s	221	71.8
	30s	60	19.5
	above 40	19	6.1
job	student	201	65.3
	work	83	26.9
	housewife	18	5.8
	others	6	1.9
mobile phone manufacturer	Samsung	122	39.6
	LG	82	26.6
	SKY	56	18.2
	Motorola	20	6.5
	KTF	20	6.5
	others	8	2.6
joined telcom. co.	SKT	145	47.1
	LGT	70	22.7
	KT	93	30.2
type of mobile phone	folder	125	40.6
	slide	129	41.9
	swing folder	10	3.2
	others	44	14.3
used period	under 6mo.	79	25.6
	6mo.~1yr.	117	38.0
	1yr.~2yr.	80	26.0
	2yr.~3yr	24	7.8
	above 3yr.	8	2.6
select reason	price	57	18.5
	design	96	31.2
	quality	87	28.2
	A/S	10	3.2
	brand	18	5.8
	other	40	13.0
desired product	Samsung	135	43.8
	LG	56	18.2
	SKY	52	16.9
	Motorola	19	6.2
	KTF	12	3.9
	other	34	11.0

<Table 2> Response score of the property

question(variable)	mean	s.d.
Call Quality	5.93	1.11
After Service	5.99	1.17
Button Operating	5.43	1.40
Battery Life	5.70	1.32
Price	5.57	1.36
Design	5.92	1.10
Color	5.36	1.32
Solidity	5.61	1.16
Internet	4.10	1.70
Convergence	5.09	1.61
Trend(Popularity)	4.38	1.46
Brand name	4.43	1.42

<Table 3> Questions for customer satisfaction

question	mean	s.d.
satisfaction level of overall handset-quality(Hard-Quality)	4.93	1.23
satisfaction level of customer support (Soft-Quality)	4.74	1.08

4. Data analysis

4.1 General properties of sample

To test the relationship between mobile phone 'manufacturer' and other variables, crosstabulation analysis is carried. The test was carried also for 'telecom company'. <Table 4> shows the results of the test and p-values of each two crossing variables. Except gender and used period, <Table 4> shows that 'maunfacturer' and 'telecom company' have significant difference with other variables. According to <Table 5>, Samsung product 'used period' is the longest among handsets, but SKY product is the shortest. More than two years of 'used period' are just 10.4%, so we can infer that the replacement cycle of mobile phone is less than 2 years mostly. The mean of 'used period' of LG Telecom subscribers is less than SKT and KT subscribers. According to <Table 6>, the main

<Table 4> Result of Crosstabulation Analysis(* p-value)

variable	gender	age	job	manufac-turer	telecom company	phone type	used period	select reason	desired product
manufacturer	0.152*	0.000	0.000	–	0.000	0.036	0.000	0.000	0.000
telecom company	0.365	0.017	0.007	0.000	–	0.047	0.064	0.000	0.000

<Table 5> Crosstabulations for 'used period'

		used period					Total(%)	mean
		1(under 6mo.)	2(6mo.~1yr.)	3(1yr.~2yr.)	3(2yr.~3yr.)	4(above 3yr.)		
manufacturer	Samsung	23	37	45	14	3	122(39.6)	2.48
	LG	22	33	19	5	3	82(26.6)	2.20
	SKY	22	21	12	1	0	56(18.2)	1.86
	Motorola	6	10	2	0	2	20(6.5)	2.10
	KTF	2	15	2	1	0	20(6.5)	2.10
	others	4	1	0	3	0	8(2.6)	2.25
	Total(%)	79(25.6)	117(38.0)	80(26.0)	24(7.8)	8(2.6)	308	2.24
telecom company	SKT	34	60	33	12	6	145(47.1)	2.28
	LGT	27	20	17	4	2	70(22.7)	2.06
	KT	18	37	30	8	0	93(30.2)	2.30
	Total(%)	79(25.6)	117(38.0)	80(26.0)	24(7.8)	8(2.6)	308	2.24

<Table 6> Crosstabulations for select reason

		select reason						Total(%)
		price	design	quality	A/S	brand	others	
manufacturer	Samsung	18	24	49	7	7	17	122(39.6)
	LG	24	32	9	1	2	14	82(26.6)
	SKY	11	28	5	1	6	5	56(18.2)
	Motorola	2	7	8	0	1	2	20(6.5)
	KTF	2	3	10	1	2	2	20(6.5)
	others	0	2	6	0	0	0	8(2.6)
	Total(%)	57(18.5)	96(31.2)	87(28.2)	10(3.2)	18(5.8)	40(13.0)	308
telecom company	SKT	9	46	53	8	14	15	145(47.1)
	LGT	31	22	3	0	1	13	70(22.7)
	KT	17	28	31	2	3	12	93(30.2)
	Total(%)	57(18.5)	96(31.2)	87(28.2)	10(3.2)	18(5.8)	40(13.0)	308

reason for selecting Samsung and KTF handsets is 'quality'(40%, 50%) and for LG and SKY handsets is 'design'(39%, 50%). On the whole, the reason comes 'design'(31.2%), 'quality'(28.2%), and 'price'(18.5%) in that order. SKT subscribers preferred 'quality' and 'design' while LGT subscribers preferred 'price' and 'design'. This shows that 'design', 'quality' and 'price' are primary properties to select handset and telecom company. 48.7%(150) of the respondents wanted to purchase other manufacturer's handset when they repurchase it. It seems that almost half of the respondents do not satisfy with their handsets. And 14.3% of the respondents answered 'others' in the handset type question and 11% answered 'others' in the desired product question. These results might be caused by the heating competition in mobile phone market and the influence of smart phone which recently become globally popular.

4.2 Factor and Reliability Analysis

A factor analysis was performed to reduce the 12 properties(<Table 2>) to a meaningful, interpretable, and manageable set of factors. The results of the dimensionality and reliability assessment for the measures are shown in <Table 7>. The dimensionality of each measure was evaluated with exploratory factor analysis. The principal component method was used for factor extraction and the VARIMAX method of rotation was employed. The results of exploratory factor analysis show that, in this study, four factors emerged as dimensions of the mobile phone properties. Those eigenvalues are greater than 1 which is a critical value. A variable with factor loading equals to or greater than 0.5 was considered significant and included in the analysis. All factor loadings are relatively high and significant, providing strong evidence for convergent validity. The results of KMO(Kaiser-Meyer-Olkin) Measure of Sampling Adequacy(0.766) and Bartlett's Test of Sphericity(p=0.000) show that the sample is suitable to factor analysis. These four dimensions, with 12 properties, explained 62.59% of the total variance. The four dimensions were named : 'Hardware Quality' (factor1), 'Practicality'(factor 2), 'Convergence Functions' (factor 3), and 'Level of Awareness' (factor 4). The reliability test conducted for each factor indicated that the reliability

coefficients for the four factors ranged from 0.61 to 0.85, which exceeded the recommended significant level of 0.60(<Table 7>). Therefore, good internal consistency among the attributes within each dimension was found. 'Hardware Quality' dimension is similar to the dimensions, External factors (design, color, size, price) and Internal factors(performance, call quality, after service, durability), of Lee and Kim(2001)[6]. The reliability coefficient (Cronbach's alpha) is calculated to test the internal consistency of the properties (questions). <Table 7> shows the reliability coefficients obtained through the evaluation of properties. As <Table 7> shows, the reliability coefficients are higher than 0.6 and so the internal consistency reliability is acceptable. Based on the results of factor analysis, 'Hardware Quality' and 'Practicality' appear to be important contributors to the importance of mobile phone. As seen in <Table 7>, those two factors account for 38.5% of the total variance. Also, 'Hardware Quality' and 'Practicality' contains eight of the 12 attributes from the scale.

<Table 7> Dimensionality and Reliability of the Measure

(Latent) Variables	Property	factor loading	Eigenvalue (var. %)	Cronbach' α
Hardware Quality	Call Quality	.636	2.460 (20.497)	0.762
	After Service	.617		
	Button Operating	.745		
	Battery Life	.833		
Practicality	Price	.546	2.157 (17.972)	0.723
	Design	.764		
	Color	.726		
	Solidity	.607		
Convergence Functions	Internet	.784	1.569 (13.071)	0.688
	Convergence	.724		
Level of Awareness	Trend(Popularity)	.714	1.326 (11.048)	0.671
	Brand name	.850		

Kaiser-Meyer-Olkin Measurement : 0.766
Bartlett's sphericity test(chi-square) : 885.717
p-value < 0.000

4.3 Regression Analysis

A regression analysis is used to further investigate the relative importance of the four factors in predicting customer satisfaction of overall handset-quality. <Table 8> shows the results of regression analysis in which the four factors used as independent variables and customer satisfaction of overall handset-quality as dependent variable. According to the results of regression analysis shown in <Table 8>, the four factors together explained 63% of the variance in the evaluation of customer satisfaction, which was significant as indicated by the F-value. The significance values of three factors are less than the significant level of 0.05. The results indicated that the regression model is statistically significant and that the three factors positively affect the respondents' evaluation of the customer satisfaction. An examination of t-values for the four factor scores indicates that the most important factor score in predicting the customer satisfaction evaluation is factor score2(correspond to 'Practicality'), folndwed by factor score1('Hardware Quality'), factor score3('ther explainf custome'). It appears that handset manufacturer should make more efforts to improve its customer satisfaction along these three critical factors.

4.4 Structural Equation Model Analysis

Based on the factor analysis, Structrual Equation Model(SEM) was tested using Amos 7.0. <Fig. 1> shows the model to analyze the influence of the properties to customer satisfaction and standardized path coefficients The structural equation modeling fit statistics is showed in <Table 9>. Although the RMR(root mean square
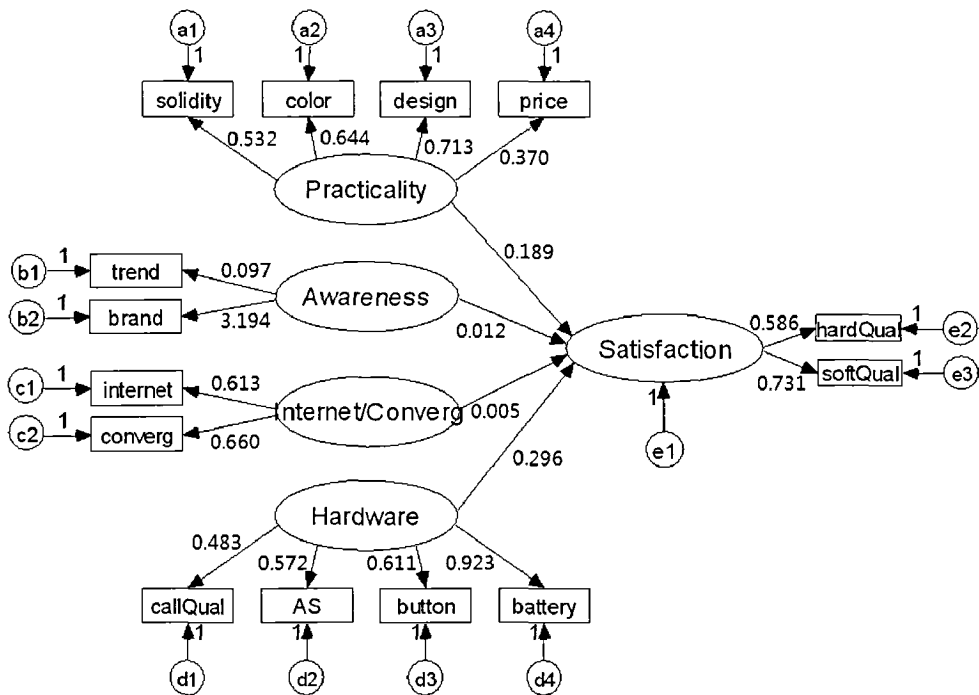
residual) is not within acceptable ranges, SRMR(standardized root mean squared residual) and all other indexes fit accept level. Based on the model fit, the structural model is acceptable. The SEM results, along with their associated path coefficients, are shown in <Table 10>.

The data indicates that 'Hardware Quality' and 'Practicality' have significant and positive

<Table 8> Regression Analysis for Factor Scores

ANOVA	SS	d.f.	MS	F	p-value
Regresson	155.809	4	38.952	38.350	.000
Residual	307.760	303	1.02		
Total	463.569	307			

	Non-stand. Coef.		Stand. Coef.	t	p-value
	B	S.E.	Beta		
(Constant)	4.932	.068		72.009	.000
Factor Score 1	.143	.069	.117	2.088	.038
Factor Score 2	.199	.069	.162	2.908	.004
Factor Score 3	.141	.069	.115	2.056	.041
Factor Score 4	.062	.069	.051	.908	.365

<Fig 1> Structural Equation Research Model(standardization)

<Table 9> Measures of SEM Fit

	$\chi^2(p)$	$\chi^2(p)$/df	Absolute Fit Index				Relative Fit Index		
			RMR (SRMR)	GFI	AGFI	RMSEA	NFI	TLI(NNFI)	CFI
Model Fit	66.757(.114)	1.24	0.085(0.051)	0.971	0.943	0.028	0.935	0.977	0.986
Accept Level	p > 0.05	1~2	<0.05(<0.08)	>0.90	>0.90	<0.05	>0.90	>0.90	>0.90

<Table 10> Summary of Test Results for the SEM

Hypothesis Path			Estimate	S.E.	C.R.	P Label	α=0.05
Customer Satisfaction	<---	Convergence Func.	.003	.082	.042	.967	기각
Customer Satisfaction	<---	Hardware Quality	.174	.063	2.787	.005	채택
Customer Satisfaction	<---	Practicality	.220	.110	1.986	.047	채택
Customer Satisfaction	<---	Level of Awareness	.002	.137	.014	.989	기각

effects to Customer Satisfaction under significant level 0.05. These results are similar to that of regression analysis for factor score.

But, inconsistent with our hypotheses, the data shows that 'Convergence Functions' and 'Level of Awareness' have no significant effect on customer satisfactions. As shown in the results, 'Hardware Quality' and 'Practicality' are essentially important and will play a key role in evaluating Customer Satisfaction.

5. Conclusion and Discussion

Global mobile phone market is prospected to be improved about 6~14% in 2010. Domestic subscribers of mobile telecommunication service company have increased 5% annually on average, but the market has reached to a saturated state and mobile phone-related industries' growth will be slow down and the market will be saturated in 2010[9]. Whole market scale of domestic mobile phone is expected about 24 million handsets and smart phone of them will be approximately 2 million(0.5 million, 2009)[12].

The mobile phone market is expected to heat up during 2010. Therefore, mobile phone companies should look for new strategies to maintain present customers and increase sales.   In this study, mobile phone-related character-istics of customers were explored. And, it is analyzed that the factors of mobile phone properties and the relation between customer satisfaction and properties of mobile phone by Structural

Equation Modeling. The following results of this study will be effectively used for the management policy of mobile phone marketing. First, the cases that used period is more than 2 years are just 10.4% of all, therefore this can be inferred that replaced period of mobile phone is less than 2 years. According to the average used period of mobile phone by joined telecom company, that of LG Telecom is shorter than SKT and KT. The main reasons for choosing handset on service are 'Quality' by Samsung product holder, 'Design' by LG and SKY, 'Quality' and 'Design' by SKT subscribers, and 'Price' and 'Design' by LGT subscribers. The result showed that design, quality and price are more important than any other reason on choice of mobile phone handset and telecom company. When the respondents repurchase mobile phone, 48.7% of them wanted to purchase other manufacturer's handset. It seems that almost half of the respondents do not satisfy with handsets they have used. These results might come form the fact that the life cycle of mobile phone become shorter by the heating competition in mobile phone market and ,to some degree, the influence of smart phone which recently become globally popular. Second, four factors, 'Hardware Quality', 'Practicality', 'Convergence Functions' and 'Level of Awareness', are induced from the mobile phone properties. Based on the results of factor analysis, 'Hardware Quality' and 'Practicality' appear to be important contributors

to the importance of mobile phone. In regression analysis by factor scores, 'Practicality', 'Hardware Quality', and 'Convergence Functions' have positive and significant effect to Customer Satisfaction. In Structural Equation Model analysis, 'Hardware Quality' and 'Practicality' have significant and positive effects on Customer Satisfaction. According to the results, 'Hardware Quality' and 'Practicality' are essentially important and will play a key role in evaluating Customer Satisfaction. 'Convergence Functions'(internet, digital camera, mp3 etc.) is appeared to be significant factor in regression analysis because of the various program and powerful functions that hard to use before. SKT surveyed the purchase reason to the T-omnia2 program subscribers. According to the report, the response was 'Various Functions'(56%), 'Advanced Mobile-Phone Image'(12%), 'Essential Function Application'(16%), 'Various Application'(13%) and 'E-Mail Function'(3%) [13]. With the new technology and the popularization of mobile phone, the functions and designs of mobile phone have been varied rapidly. These show that 'trand' and 'brand name' are not relatively important than other factors. According to this study, customer satisfaction of mobile phone is closely related to 'Practicality' factor(representing 'Design' and 'Price') and 'Hardware Quality' factor (representing 'Call Quality' and 'A/S'). The results of this study could provide useful information to mobile phone companies. From the review of the study, they can manage their core properties of product effectively and produce new strategic methods to secure their competitiveness. The present study has some limitations that should be addressed in future study. This study was implemented somewhat comprehensive approach in consideration of

respondents' circumstances, but the properties need to be more segment-specific for more precise result. Most of the respondents are university students and their residential area is restricted to Gwangju Metropolitan City; hence, there may be a sampling bias. And, if this study perform with service quality properties then the result will be more appropriate and useful.

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이동전화기 속성이 이동전화기 및 통신사 선택에 미치는 영향 분석

김현종

요 약

지금까지 이동전화 관련 산업은 시장점유율 증대를 위한 신규고객 확보에 주력하였으나 관련 시장은 이미 포화상태에 도달하여 신규고객 확보보다 기존고객 유지를 위한 새로운 전략을 모색하여야 한다. 본 연구에서는 이동전화기와 관련된 고객의 특성을 살펴보고 이동전화기의 속성요인들에 대하여 분석한 후 고객만족도와 이동전화기 속성요인들과의 관계를 구조방정식을 이용하여 분석하였다. 사용기간이 2년 이상인 경우는 전체의 10% 정도로 나타났으며, 재구매시 현재 사용중인 제품과 다른 회사의 제품을 구입하겠다는 응답이 49% 정도로 나타났다. 이러한 결과는 다양한 제품의 출시와 번호이동 등의 치열한 제품경쟁으로 인한 이동전화기의 수명이 짧아졌기 때문이라는 사실과 더불어 최근에 세계적으로 인기를 끌고 있는 스마트폰의 영향이 있는 것으로 생각된다. 고객만족도와 관련된 이동전화기의 속성으로부터 4가지 요인(실용성, 기기 품질, 인지도, 복합기능)이 도출되었다. 실용성과 기기품질이 고객만족에 영향을 주는 주요요인으로 밝혀졌고, 인지도(브랜드, 유행 등)는 고객만족에 상대적으로 영향력이 떨어지는 것으로 나타났다.

주제어 : 이동전화기, 통신사 선택, 신규고객, 고객만족도