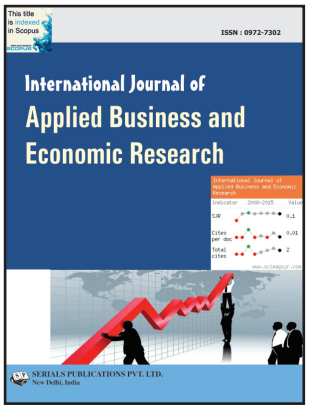

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Technology Innovation and Diffusion in the Smart Age: Focusing on the Diffusion Factors of the Wearable Device[1]

Wookjoon Sung[2], Ki-whan Kim[3], Sangoh Yun[4] and Dongwook Kim[5]

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[2]*First Author Graduate School of Public Policy & Information Tech., Seoul National University of Science &Technology, Korea. Email: wjsung@seoultech.ac.kr*

[3]*Department of Public Administration, Seoul National University of Science &Technology, Korea. Email: kiwkim@seoultech.ac.kr*

[4]*Department of Public Administration, Dankook University, Korea. Email: yuliss@dankook.ac.kr*

[5]*Corresponding Author, Graduate School of Public Administration, Seoul National University, Korea. Email: dong@snu.ac.kr*

ABSTRACT

This paper is an empirical study on "what are the factors that affect the proliferation of new technology-based products or services?" The dependent variable is the adoption of wearable devices. Independent variables are demographic factors (gender, age, education, occupation, income) device factors (device performance, brand), digital behavioral factors (frequently used apps), and psychological factors (purchase style, personality). We did logistic analysis with the data from 2015 KISDI media panel survey. As a result, purchasing of wearable devices is considered to be an initial stage that is influenced by device performance and brand rather than factors such as usage of contents. As a result of logistic regression analysis, income among demographic variables, device performance, and the brand of interlocking device are significant influence variables. According to the analysis, the initial spread of wearable devices mainly depends on the performance excellence or brand loyalty of wearable devices or interlocking devices (eg smart phones).

Keywords: Wearable computer, Wearable service, Wearable device, technology adoption.

1. INTRODUCTION

In the 21st century, the battle over technological innovation is fiercer than ever. The emergence of new products and services as a result of the development of information and communication technology (ICT) has led to the spread of global technology and the acceleration of competition across borders. The emergence of broadcasting-telecommunication convergence services (DMB, IPTV), which began in the

late 2000s, has accelerated competition in the media convergence market, breaking the boundaries between broadcasting and telecommunication areas. The smart big bang launched with the emergence of smart phones is accelerating not only the convergence of C-P-N-D such as Smart TV, N-screen and cloud service, but also new convergence with other industries such as wearable device, Fintech, O2O, and automatic driving car and so on.

However, these innovations and their proliferation are not always successful. Also, the emergence of new products and services through technological innovation does not always lead to successful proliferation. Moreover, even if technological innovation happens, the speed of innovation does not equal, and it does not have the same success factors. Identifying what factors work is critical to the initial proliferation of innovative services.

This paper is an empirical study on "what are the factors that affect the proliferation of new technology-based products or services?", Which is one of the most important questions that are repeated in the field of ICT. In Chapter 2, we introduce wearable devices and examine the factors that influence the diffusion of innovative services through previous studies. Chapter 3 explains the research analysis framework, data collection and analysis methods, and Chapter 4 shows the empirical analysis results. Chapter 5 provides recommendations for the successful diffusion of wearable devices as an innovation service.

2. LITERATURE REVIEW

2.1. Wearable Device

Wearable devices are one of the hottest issues in ICT in 2016, and Gartner (2014) said "By 2016, Smartwatch will account for 40% of total consumer wrist wear market ....."

Wearable devices are clothing and accessories incorporating computer and advanced electronic technologies. Wearable devices is related to cutting-edge technology like Internet of Things and smart devices.

These days, Wearable devices are becoming widespread in the form of watches or bands that can work with smartphones and take advantage of the functions of smartphones like Apple watch, Galaxy gear, Xiaomi band.

2.2. Factors Affecting the Spread of Wearable Appliances

In the previous studies, factors affecting the purchase of new ICT products and services can be divided into three categories: consumer factors, service and product factors, and market characteristics of information and communication.

First, consumer factors. Specifically, consumer demographics, consumer characteristics, and consumer buying tendencies are important factors in the purchase of new products and services.

Basically, demographic factors such as age, sex, occupation, and education are important factors in the purchase of new products. Noteworthy is the trend of recent consumer research related to the purchase of the latest products or services. Classification about innovative consumers in the study are widely known (Rogers, 1964). In a study of the diffusion of innovation on how adoption and diffusion of new technologies

were introduced, he divided consumer types into five categories. It is divided into Innovator, Early adopter, Early majority, Late Majority, Late Majority and Laggards according to the speed of acceptance of innovative products by consumers. Innovators and early adopters play an important role in the diffusion of new technologies. Recently, researches on the relationship between innovation diffusion and consumers have focused on the role of consumers in spreading new products or services using more diverse concepts. Appel (2012) is paying attention to the characteristics of heavy users who are spending more time on new devices and empirically increasing their interest and proficiency in products. Also, the discussion on power users (Zhong, 2013), which plays a leading role in the purchase of other people's products or services in the proliferation of new products, is also considered important. The effect of consumer characteristics on the spread of wearable devices is shown in the following hypotheses.

H1: There will be differences in wearable device adoption by demographic variables.

H2: Individual personality and purchasing tendency will affect the adoption of wearable devices.

Second, in terms of services and products, the innovation and superior performance of new products · services · contents affect the initial purchase and diffusion of products based on technological innovation. In other words, the development of the latest products based on ICT innovations will contribute to the spread of innovation (Agarwal and Prasad, 1998; Zhong, 2013). Also, if new services or contents that could not be experienced in the past are provided by the devices, it will be possible to spread them.

H3: The higher the performance of the interlocking device, the more purchases of wearable devices will be.

H4: The adoption of wearable devices will vary depending on the type of user's utilization contents.

Third, characteristics of ICT market such as acceleration of convergence of value chain (Contents-Platform-Network-Device), lock-in effect, and brand loyalty may affect information and communication products and services. One of the biggest changes in the value chain of the telecommunications sector is the convergence of C-P-N-D. The boundary between C-P-N-D is collapsed and connected to one ecosystem (Arlandis and Ciriani, 2010; Fransman, 2007; Icelandic and Levien, 2004). This can lead to a lock-in effect between each value chain in the telecommunications market. For example, if a person using Apple's IPod, iPhone, iPad, Apple Notebook, or Appstore is purchasing a wearable device, it is likely to choose Apple watch. Differences in loyalty to each of these brands can affect the purchase of smart devices.

H5: The adoption of smart devices by brand of interlocking devices will be different.

3. METHODOLOGY

This study is an empirical study of factors affecting the initial diffusion of wearable appliances. Dependent variables are wearable devices, and explanatory variables are divided into three categories according to previous research. First, the sociodemographic variables were divided into sex, age, education level, income and occupation status. Second, psychological factors related to consumption were divided into personality and purchase intention. Finally, digital environment factors were divided into device performance, utilization contents, and device brand.

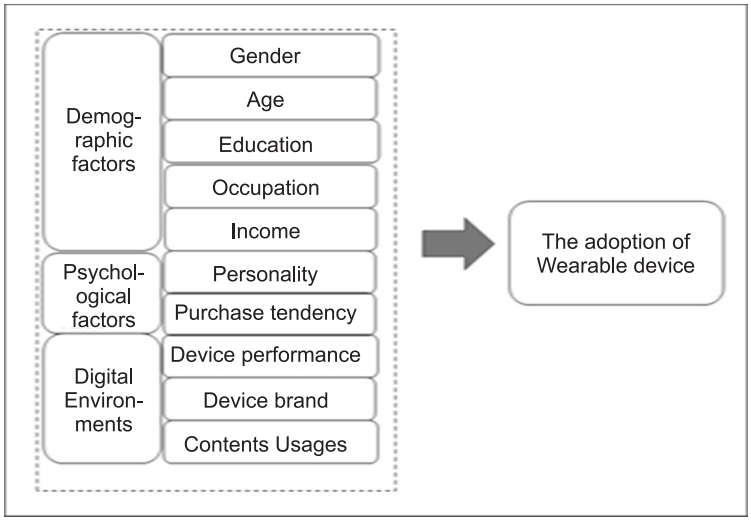

Figure 36.1

3.2. Data and Measurements

To test our hypothesis, we used data from the Korea Information Society Development Institute (KISDI) Media Panel Survey 2012 and 2015. These data are government official statistics (no.40501), which are produced by the Korean National Statistical Office.

The dependent variable is the adoption of wearable device. The independent variables are demographic factors (gender, age, education, employment status, income), device performance (3G, LTE, LTE-A), device brand (Samsung, Apple, LG, Others), personality (change seeking, harmony seeking, psychological stability), purchase tendency (fashionable, practical), wearable device contents. The explanations and measurement methods of major variables are shown in Table 36.1.

Table 36.1
Variable description and Measurement

	Variable name	*Variable description*	*Measuring Variables*
Dependent variable	Wearable device acceptance	Whether to have a wearable device such as smart watch in conjunction with a smartphone	0 = none 1 = Yes
Demographic factor	Gender	Female, male	Female = 0, Male = 1
	Age	Less than teenager = 1 20-29 = 2, 30-39 = 3, 40-49 = 4 50-59 = 5, 60 or more = 6	(Dummy variable) Reference group: 20-29
	Education	Less than elementary school = 1 Lower than middle school level = 2 Less than high school = 3 College degree or higher = 4	(Dummy variable) Reference group: Less than high school(3)
	Job	Job	0=No occupation 1=Occupation:
	Monthly income	Average monthly income	1 = less than 1 million won 2 = 100-199,

Variable name		*Variable description*	*Measuring Variables*
			3 = 200-299 4 = 300-399 5 = 400-499 6 = 500 or more
Purchasing Psychological Factors	Personality	<The propensity to pursue innovation> – I enjoy adventure. – I like change. – I am improvised and free, and I hate to be bound by rules. <Extroversion> – I like to be with someone else – I like to be interested. – I enjoy conversations and lead conversations with others. <Psychological stability orientation tendency> – I have no emotional changes. – I rarely get angry. – I do not have much worries. – I am bright in everything – I believe others well.	Factor analysis .Reliability analysis Use factor score
	Consumption Behavior (Purchasing tendency)	<Trend seeking purchase propensity> – It is important that I am the latest product. – Goods that others do not use are more attractive. – Be fashionable <Practical buying propensity> – It is important that the price is low with minimal functionality – Identify the goods and bargain the prices – Use the Internet to buy goods cheaply	Factor analysis .Reliability analysis Use factor score
ICT environment factors	Smartphone type	Smartphone performance 1. 3G Smartphone 2. 4G smartphone 3. LTE-A Smartphone	(Dummy variable) Reference group: 3G
	Product brand	1. Samsung 2. LG 3. Apple 4. Pantech 5. Other	(Dummy variable) Reference group: Pantech
	Usage Behavior (Main content)	1. Spending Management/Finance, Shopping 2. Living information/weather (health care), sports 3. Map/Navigation 4. Messenger 5. Schedule Management 6. Music, videos, photos 7. Smartphone content not available on wearable devices	(Dummy variable) Reference group: Smartphone content not available on wearable devices (7)

4.1. Descriptive Statistics

Table 36.2 shows the descriptive statistics of major variables and the status of wearable equipment by major variables. According to the status of wearable devices, 5% of all respondents have wearable devices. According to the main variables, the male ratio is higher than the female ratio, and the ratio of 40s is the highest. Occupation group, college education group, high income group have high wearable equipment hold ratio. By device performance, LTE-A holders had a high retention rate, and Apple users had the highest by brand.

Table 36.2
Descriptive Statistics

		Wearable Device		*Total*
		No device	*Device*	
Gender	Male	3150 (94.9%)	171 (5.1%)	3321 (100.0%)
	Female	3511 (95.1%)	179 (4.9%)	3690 (100.0%)
Total		6661 (95.0%)	350 (5.0%)	7011 (100.0%)
Age	Less than teenager	1038 (95.6%)	48 (4.4%)	1086 (100.0%)
	20-29	863 (94.6%)	49 (5.4%)	912 (100.0%)
	30-39	1066 (94.5%)	62 (5.5%)	1128 (100.0%)
	40-49	1802 (94.0%)	115 (6.0%)	1917 (100.0%)
	50-59	1242 (95.9%)	53 (4.1%)	1295 (100.0%)
	60 or more	650 (96.6%)	23 (3.4%)	673 (100.0%)
Total		6661 (95.0%)	350 (5.0%)	7011 (100.0%)
Occupation	No occupation	2979 (95.4%)	144 (4.6%)	3123 (100.0%)
	Occupation	3682 (94.7%)	206 (5.3%)	3888 (100.0%)
Total		6661 (95.0%)	350 (5.0%)	7011 (100.0%)
Education	Less than elementary school	507 (96.8%)	17 (3.2%)	524 (100.0%)
	Lower than middle school level	611 (96.4%)	23 (3.6%)	634 (100.0%)
	Less than high school	2650 (95.1%)	137 (4.9%)	2787 (100.0%)
	College degree or higher	2893 (94.4%)	173 (5.6%)	3066 (100.0%)
Total		6661 (95.0%)	350 (5.0%)	7011 (100.0%)
Monthly income	Less than 1 million won	3296 (95.7%)	148 (4.3%)	3444 (100.0%)
	100-199	1217 (95.4%)	59 (4.6%)	1276 (100.0%)
	200-299	1041 (94.7%)	58 (5.3%)	1099 (100.0%)
	300-399	633 (94.6%)	36 (5.4%)	669 (100.0%)
	400-499	285 (91.9%)	25 (8.1%)	310 (100.0%)
	500 or more	189 (88.7%)	24 (11.3%)	213 (100.0%)
Total		6661 (95.0%)	350 (5.0%)	7011 (100.0%)
Smartphone type	3G	1010 (97.2%)	29 (2.8%)	1039 (100.0%)
	LTE	3843 (95.3%)	189 (4.7%)	4032 (100.0%)
	LTE- A	1808 (93.2%)	132 (6.8%)	1940 (100.0%)
Total		6661 (95.0%)	350 (5.0%)	7011 (100.0%)

		Wearable Device		*Total*
		No device	*Device*	
Smartphone Brand	Samsung,	4645 (95.0%)	243 (5.0%)	4888 (100.0%)
	LG	1312 (95.4%)	63 (4.6%)	1375 (100.0%)
	Apple	363 (91.9%)	32 (8.1%)	395 (100.0%)
	Pantech	324 (96.4%)	12 (3.6%)	336 (100.0%)
	Other	15 (100.0%)	0 (0.0%)	15 (100.0%)
Total		6659 (95.0%)	350 (5.0%)	7009 (100.0%)

4.2. Results of Logistic Regression

Logistic regression analysis was conducted to analyze factors affecting smart device purchase. The Chi square value (0.00) and the Hosmer & Lemeshow test value ($p < 0.05$) were found to be appropriate to test the fit of the model. The explanatory power of the model was Cox & Snell R2(0.08), and Nagelkerke R2(0.093).

As a result of logistic regression analysis, income was a significant variable among demographic variables. Psychological factors related to consumption were not significant. In the telecommunication environment, the brand of interlocking device is a significant influence variable. More specifically, the higher the income, the more likely to have a wearable device, and the higher the performance of the interlocked device, the higher the probability of having a wearable device. By brand, Apple brand users are more likely to purchase wearable appliances.

Table 36.3
Results of multiple regression

		B	*S.E.*	*Exp (B)*	*EXP(B) 95% C.I.*	
					Lower	*Upper*
Gender		.144	.158	1.155	.847	1.575
Age (Reference group: 20-29)	Less than teenager	.017	.306	1.017	.559	1.851
	30-39	–.040	.234	.961	.608	1.520
	40-49	–.031	.234	.969	.613	1.532
	50-59	–.361	.272	.697	.409	1.187
	60 or more	–.309	.378	.734	.350	1.541
Education Reference group: Less than high school	Less than elementary school	–.157	.633	.855	.247	2.960
	Lower than middle school level	.292	.363	1.340	.657	2.730
	College degree or higher	–.132	.148	.876	.656	1.171
Job		–.260	.180	.771	.542	1.096
Income		.208***	.063	1.231	1.089	1.392
Personality	Change-seeking	–.083	.061	.921	.817	1.038
	Harmony	–.023	.065	.977	.860	1.110
	Psychological stability	.053	.064	1.054	.931	1.194

		B	*S.E.*	*Exp (B)*	*EXP(B) 95% C.I.*	
					Lower	*Upper*
Purchase tendency	Fashionable	.097	.077	1.102	.947	1.282
	Practical	.072	.073	1.074	.932	1.239
Device performance	LTE	.465**	.235	1.593	1.004	2.526
	LTE-A	.834***	.243	2.301	1.431	3.702
Wearable devices contents (Reference group: Smartphone content not available on wearable devices	Contents 1	–.064	.194	.938	.641	1.373
	Contents 2	.181	.175	1.198	.851	1.688
	Contents 3	.245	.150	1.277	.952	1.713
	Contents 4	–.270	.518	.763	.276	2.107
	Contents 5	–.118	.168	.889	.640	1.234
	Contents 6	.152	.144	1.165	.878	1.546
Device brand	Samsung	–.141	.174	.869	.618	1.221
	Apple	.549**	.237	1.731	1.088	2.754
	LG	–.334	.371	.716	.346	1.482
	Others	–18.087	17788.088	.000	0.000	

4. CONCLUSION

This research is an exploratory study related to the proliferation of wearable devices which is spreading recently. The dependent variable is the adoption of wearable devices. Independent variables are demographic factors (gender, age, education, occupation, income) device factors (device performance, brand), digital behavioral factors (frequently used apps), and psychological factors (purchase style, personality). We did logistic analysis with the data from 2015 KISDI media panel survey. As a result, purchasing of wearable devices is considered to be an initial stage that is influenced by device performance and brand rather than factors such as usage of contents. As a result of logistic regression analysis, income among demographic variables, device performance, and the brand of interlocking device are significant influence variables.

According to the analysis, the initial spread of wearable devices mainly depends on the performance excellence or brand loyalty of wearable devices or interlocking devices (eg smart phones). This means that there is a possibility of further spread in the future as the performance of wearable or interlocked devices is improved. However, it seems that the wearable device is still not enough to construct innovative killer content that other devices cannot see. Given the impact of killer content on the proliferation of innovative devices and services, it is important to develop diverse content with improved device performance.

The analysis shows Apple's brand power again. As the convergence environment of C-P-N-D accelerates, the market dominance of one field is likely to shift to market dominance of other related fields. Cooperation and strategies are needed in consideration of convergence ecosystems.

Finally, the failure to include in the model the price of a device that could affect the proliferation of a new device or service in this study is a limitation of the study by using existing data.

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