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**Article**

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## OPERATIONS, INFORMATION & TECHNOLOGY | RESEARCH ARTICLE

# An empirical comparison between China and USA market on smartphone adoption

Jong Seok Kim<sup>1\*</sup>

**Abstract:** This study examines the factors affecting users' adoption of the smartphone as an innovative device. Prior studies on the acceptance of smartphones have primarily focused on the impact of the technological benefits and characteristics. In this study, the author propose an integrated model of smartphone adoption that incorporates product benefit, technological capabilities, perceived product innovativeness, attitude for product, consumption pattern, word of mouth and advertising into the technology acceptance model in China and USA. The author used a structural equation model (SEM) which was empirically evaluated by using survey data collected from 3000 respondents with demographics to explore their perception and attitudes toward smartphone adoption intention. The results show that product benefit, technological capabilities, consumption pattern change and WOM have all positive effect on the perception of innovativeness. Attitude toward a product turned out to play mediating role between perceived innovativeness and intention of adoption. That is very valuable implication for manufacturers to prepare a marketing and to win bigger market share.

**Subjects:** Information & Communication Technology; ICT; Statistics for Social Sciences; Management of Technology & Innovation; InformationTechnology Industries

**Keywords:** SEM; PLS; innovation; smartphone adoption; technology acceptance mode

### 1. Introduction

Mobile technologies have penetrated consumer markets throughout the world. It is likely to make a deep influence on business activities, consumer behavior, and national and global markets. The smartphone industry has been also steadily developing and growing, both, in terms of market size and models. Globally, by 2021, 40% of the world's population is predicted to own a smartphone. The

### ABOUT THE AUTHOR

Dr Kim is currently a Professor at Sungkyunkwan University, Suwon, Korea. His research interests include choice modeling, new product development, technology forecasting, new product adoption, big data/cloud/IoT, manufacturing & service operation management, business model innovation, future mobile market forecasting, and high-tech marketing. He received an M.S. in ORST (Operation Research & Applied Statistics), M.B.A. in Business Administration from RPI, Troy, NY and Ph.D. in Management of Technology from Yonsei University, Seoul, Korea. He is also listed in The Marquise Who's Who in the world in

### PUBLIC INTEREST STATEMENT

This article is to help mobile manufacturers' marketing strategies and product strategies in the US and Chinese markets.

This is a paper to identify key factors that influence consumers when purchasing new mobile devices.

global smartphone market is shifting. Over the next few years, the vast majority of growth is expected to come from developing countries as the average selling price of devices continues to fall.

Meanwhile, core markets, such as the United States and China, are beginning to mature. Nearly five out of six mobile users in the US now have a smartphone, and almost all of those users are on iOS and Android phones. Meanwhile, the Chinese market continues to saturate as the share of first-time buyers increasingly shrinks. The increasing demand for high-speed data connectivity for integrated IoT (Internet of Things) applications, such as energy management and smart home products, is anticipated to propel the adoption of 5 G smartphones. The smartphone market is a highly competitive market, dominated by established players such as Samsung, Huawei, Apple, and Xiaomi, among others. Most of these players keep launching new models with small technology changes such as battery power, camera configuration, and/or processor (Mordor Intelligence, 2021). Given that the smartphone market has evolved rapidly, the author aims to analyze the influence of various factors in customers' decisions to buy smartphone by Rahim et al. (2016). Technology Acceptance Model (TAM) was used in this research to identify and compare the factors affecting the adoption of smartphones by smartphone users. For the purpose of analysis, the primary attributes for applying TAM were derived from a survey of 3000 mobile users, after which 13 hypotheses were established in the model and verified using the structure equation model (SEM) for two countries.

The goal of this investigation was to identify the key determinants that affect the adoption of smartphones in the USA and Chinese market. The author established the key determinants that affect adoption of smartphone by examining research in the field of technology acceptance, including by (Chung and Chun, 2011; Davis, 1986; Davis et al., 1989; S. Kim and Garrison, 2009; Putzer and Park, 2012; Van Biljon and Kotzé, 2007; Venkatesh et al., 2003) and by conducting survey research.

With these backgrounds, the research in this paper has several purposes. First, this study is to investigate the acceptance and adoption of smartphones and factors affecting such acceptance behaviors, and to explore the critical external variables affecting users' attitude to use and perceived usefulness of smartphone.

Second, the author intends to take a consumer's perspective in evaluating the product innovativeness by survey research. Third, this research is to understand the relationship between the perception of new product innovativeness and the consumer's intention of adoption. Lastly, the author tries to obtain different characteristics of each country.

The analysis results show that product benefit, technological capabilities, consumption pattern change and WOM have all positive effect on the perception of innovativeness. Attitude toward a product turned out to play mediating role between perceived innovativeness and intention of adoption by two countries, though the degree of influence is not equal. The author expects the research findings to provide valuable information for understanding how the mobile market has evolved and what values the customers wants as the market evolves. The study also draws a number of practical insights and provides vendors seeking to enter the Chinese and USA marketplace with specific information about mobile users' perceptions, intentions and adoption.

There is no guarantee that technology advancements will translate into successful innovation adoption. Consumers' acceptance and intentions to adopt the new technology by Son et al. (2011) are important aspects of new product marketing. Also, this study confirmed and compared earlier results from previous researchers and proposed a solid model that can be used for further studies.

The paper consists as follows: The theoretical and methodological background of this research is explained in the literature review. Then, the author describes the overall research process and

establish hypotheses. Next, the author summarizes and discuss the empirical analysis results of SEM, and conclude with notes about contributions and future research directions.

## 2. Theoretical backgrounds

### 2.1. Technology acceptance model (TAM)

Technology Acceptance Model (TAM) was proposed for explaining and predicting consumer acceptance of an information system, and it is designed specifically to interpret the acceptance process of information technologies (F. D. Davis, 1989). The original TAM consists of five components, which include perceived usefulness (PU), perceived ease of use (PEOU), attitude toward using, behavioral intention (BI) to use, and actual system use (Wu & Wang, 2005). TAM assumes that whether to adopt a particular technology is determined by two key factors: PU and PEOU for the technology (see, Figure 1). Here, PU is defined as the degree to which a person believes that using a particular technology would enhance his or her job performance, while PEOU is defined as the degree to which a person believes that using a particular technology would be free of effort (Davis, 1989). On the other hand, BI is defined as future behavior of individuals, which entails subjective probability as it relates to actual behavior (Engel & Blackwell, 1982). Actual behavior is the determinant factor in taking specific action, and BI relates to actual behavior (Ajzen & Fishbein, 1980). Subsequent research concludes that the attitude variable has weak predictors of BI (Taylor & Todd, 1995).

The current study focuses on diffusion in the smartphone industry (also known as the converged mobile device market)—in particular, the adoption of Apple iPhone. The Apple iPhone is a cultural icon of the digital age (Morrissey & Brian, 2009). Mobile phones are

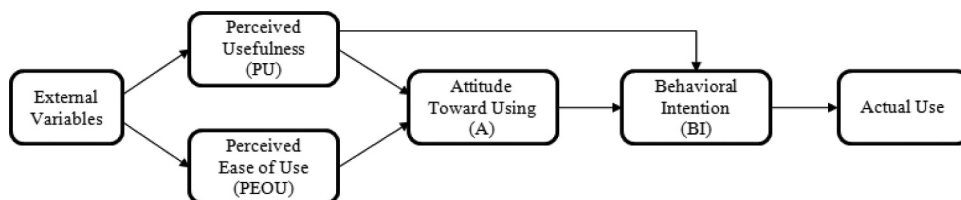
one of the most conspicuous examples of such innovations achieving a large penetration rate in many markets (John, 2012).

### 2.2. Product acceptance

The author is to examine the acceptance of a product evaluated as innovative on the consumer's perspective and the product performance on the company's perspective through these standards. Examining whether positive linear relationship is shown between consumer's perception on innovativeness and product acceptance attitude is meaningful for generally, by perspective of the company, results show of a positive linear relationship (Henard & Szymanski, 2001) between the innovative product and its performance. This is because the performance (success or failure) of a product (evaluated as innovative and put out in the market), in strict sense, will eventually be evaluated in the process for its innovativeness and acceptance by the customers (Hoffman et al., 2005; Huh & Kim, 2008; Kotler et al., 2003; Olshavsky & Spreng, 1996; Winer, 2007).

Consequently, in this study, the author will examine what factors influence consumers to perceive the innovativeness of a product released by a company and what influence this perception of innovativeness has on the attitude and intention to acceptance. This concept later found applications in studying the adoption of consumer products such as mobile phones (Guseo & Guidolin, 2010). In this paper, the study has been made to understand the importance of user

Figure 1. Technology acceptance model (Davis, 1989).



behavior and acceptance in determining one's behavior to use indigenous technology. The conceptual model combined our proposed research which consists of product benefit, technology capability, consumption pattern change (Veryzer, 1998b), and word-of-mouth (Seema Pai, 2007).

The research in this paper has several objectives. First, this study is to explore cross-cultural differences on mobile technology in global business environments (Sanakulov & Karjaluto, 2017a) and to compare with different countries. Second, the author intends to take a consumer's perspective in evaluating the product innovativeness and its performance. Third, this research is to understand the relationship between the perception of new product innovativeness and the consumer's intention of adoption.

The goal here is to provide insight into key factors that affect the evaluation of new products rather than to provide a comprehensive list of correlated with product success.

### **2.3. Product innovativeness**

Product innovativeness refers to the degree of familiarity organizations or users have with a new product (Balachandra & Friar, 1997). The degree of innovativeness can be measured by the difference between the newness of the product and the existing technology or practices in the organization. High levels of product innovativeness are fundamentally new to consumers and the current market. Also, they are associated with revolutionary changes in technological resources within the organization (Dewar & Dutton, 1986). The activities in developing high innovative products require more knowledge resources and additional skilled technicians, autonomy and dynamic capability of the team (Darawong, 2018). New Product Development team in companies seek always breakthroughs in high innovativeness so therefore they encounter high levels of operational and market uncertainty (O'Connor & Veryzer, 2001).

Essentially, high innovative products can enhance or adopt customer responsiveness (Ganji et al., 2018) and willingness to buy in highly competitive markets (Lee & Johnson, 2017). On the other hand, low product innovativeness involves minor changes or simple improvements of the product related to current business operations and products. It includes developing products that are similar to competitors or changing product attributes through the use of existing technology, knowledge and skills

(Tushman & Anderson, 1986). In addition, product innovation may be viewed a lying along dimension reflecting in: product benefits (Richard T et al.), technology capabilities (Abdul et al.), consumption pattern or usage patterns (Joe et al.), and marketing mix variables (Gatignon & Robertson, 1991). The product benefit refers to the new capabilities of the product in terms of the needs that it satisfies as perceived and experienced by the customer or user. Technological capability refers to the degree to which the product involves expanding technological capabilities (i.e., the way functions are performed) beyond existing boundaries. The consumption pattern refers to the degree of change required in the thinking and behavior of the consumer in using the product.

### **2.4. New product characteristics association with product adoption**

The author examines how new product characteristics affect the rate of diffusion, three product variables have been identified and have gained widespread acceptance: relative advantage, absolute excellence in technology, the changes in usage behavior.

Relative advantage is the perceived desirability or the benefit derived from a new product relative to those benefits offered by other existing products. Relative advantage refers to the degree to which an innovation is perceived as an advantage over an established solution. The greater the relative advantage, the faster the adoption of a new innovation. Nam and Kim (2004) found that new products with a relative advantage can achieve the greatest market penetration.

For the new product to gain rapid acceptance, the product must be seen as being more attractive than other alternatives. The product's attributes that are being used for differentiation purposes must also be perceived as both excellent and significant (Onkvisit & John, 1989). The relationship between perceived advantage and innovativeness is positive: the greater the perceived advantage, the more likely it is that the product will be adopted. In other words, both relative advantages over existing products and absolute advantage in technology factors have positive influence on consumers' perceptions on product innovativeness, acceptance intentions, and acceptance processes. However, change factors of usage behavior have positive effects on the level of perceived innovativeness but have a negative effect on product acceptance processes. An examination of previous research has shown that change factors of usage behavior have negative effects on attitude toward a new product.

The author found different results that change factors of usage behavior have positive effects on attitude toward a new product. Therefore, the author has additionally added the positive process between the change factors of required usage behaviors with product acceptance besides the assumption of its positive effects on perceptive innovativeness. Also, this study considers the intermediary role of product attitude in relationship with innovativeness perception and has established a hypothesis of direct positive process between change factors of usage behavior and attitude towards product.

Tsiros and Mittal (2000) and Buttle (1998) found that the valence of consumption experience determines the extent to which people talk about their product or service encounter. Veryzer (1998b) defined product innovativeness as a form of continuum within continuous and discontinuous factors and explained the origin of innovativeness as 1) relative advantage over existing products 2) high technology and 3) required changes in usage behaviors where discontinuous changes are perceived in one or more of the above origins in cases of discontinuous innovativeness. Research by Huh and Kim (2008) on mobile phone purchases in Korea found that if a product upgrade has innovative features, it will influence consumer adoption of a next-generation product.

Samsung & Apple have continued to strive to include product improvements with innovative features, such as the introduction of the Face ID, MagSafe wireless charging, longer battery life, better camera, 3x optical zoom, great performance, 5 G, and best video quality as part of an iPhone 13 upgrade (The Guardian, 2021). Research by Songpol et al. (2009) showed that technological innovations will be adopted more quickly due to the moderating effect of public/private consumption. This notion of social influence of users showing off or publicly consuming their product is highly applicable to the successful adoption of the Apple iPhone.

In conclusion, all the above details will be put together to establish a hypothesis on the determinants which consumers perceive the level of innovativeness of new products. This suggests the following hypothesis:

**H1-1:** The relative advantages of new products over existing products will have positive effects on the perception of product innovativeness.

**H1-2:** Absolute excellence in technology of new products will have positive effects on the perception of product innovativeness.

**H1-3:** The changes in usage behavior required for new products will have positive effects on the perception of product innovativeness.

More details of measurement variables about this model are displayed in [Table 2](#).

Next, the author tests the proposed model based on empirical data.

### **2.5. Direct formation attitude for new product**

The relationship between innovativeness and product acceptance has formerly been evaluated as linear and nonlinear in previous studies. Therefore, in establishing the hypothesis for product innovativeness and consumer attitude & intention of product acceptance, this research will establish its own hypothesis based on the positive (+) linear relationship (Henard & Szymanski, 2001) between innovativeness and product acceptance indicated in previous researches as well as verifying the nonlinear relationship (Goldenberg et al., 2001; Steenkamp et al., 2003; Veryzer, 1998b) between the two factors. However, the author hopes to change the use of the term “product performance” to “product acceptance” in the future as the product performance in consumers’ perspective stands for product acceptance. Meanwhile, Rogers (1995) stated that both favorable and unfavorable attitude formation has certain effects on product acceptance. However, this study will assume that the level of product acceptance is higher for consumer groups with better attitude towards products and focus on looking into the intermediary roles of consumer attitude in the relationship with “perceived innovativeness—attitude formation—intentions for product acceptance”. This will eventually be another approach to verifying the product acceptance hierarchy model, which Gatigon and Robertson (1985) evaluated more appropriately for high involvement products.

This suggests the following hypothesis:

**H2:** The level of perceived innovativeness for new products will have positive effects on attitudes towards products.

**H3:** Attitude towards new products will have positive effects on product acceptance intentions.

**H4:** Attitude towards new products will mediate the perceived effect levels.

### **2.6. The role of WOM in the new product adoption**

Communication strategy is a critical element of new product adoption. The decision to adopt a new product is determined by the success of a sequence of two stages: product awareness and product adoption. Previous research has established the importance of WOM as a driver of new product diffusion (López et al., 2013). Studies have also highlighted the importance of WOM in new product diffusion. However, the expansion of new media has facilitated the development and management of word-of-mouth campaigns. Leonard-Barton (1985) shows a positive relationship between opinion leaders’ attitudes and product adoption rates, suggesting that experts can influence consumers, regardless of whether the WOM is positive or negative. Sweeney et al. (2014) shows that positive WOM was more effective and positive WOM messages had a greater effect on people’s willingness to use a service than did negative WOM.

In many cases, the adoption of innovativeness consumer technology products is driven in part by the desire to gain approval and avoid disapproval (Slama & Wolfe, 1999). WOM is perceived as being more helpful, because consumers can find richer and more varied information than advertising can provide, by mixing objective and subjective information (Ghose & Ipeirotis, 2007). Thus, it is more likely that individuals will talk about a new product when receiving information from other consumers, than when exposed to advertising. For this reason, word of mouth communication should have a relatively greater impact on adoption decisions in product categories where (1) consumers attach meaning to innovation adoption; and (2) innovation use is observed by others.

This suggests the following hypothesis:



**H1-4:** Word of mouth message new product will have positive effects on perception of product innovativeness.

Advertising for new product can be reasonable means for consumer's attitude (Wansink et al., 1998). That is true for the relationship between the construct attitude toward advertising and attitude toward mobile marketing (Tsang et al., 2004). Many empirical studies of attitudes toward mobile advertising (Okazaki, 2004; Tsang et al., 2004) borrowed the factors from internet advertising to predict consumer. Previous studies have shown advertising to be the tool that works best during the first stage of introduction. Advertising allows firms to make consumers aware that it has developed an innovation over existing state-of-art product. Consumers become generally aware of a new product only gradually. In this gradual process of product knowledge diffusion, the more a product is advertised, the more consumers become aware of the product. Lavidge and Steiner (1961) first suggested that consumers respond in terms of a hierarchy of effects, which is a sequence of stages a prospective buyer goes through from initial awareness of a product to eventual action. The sequence is Awareness→Interest→Evaluation→Trial→Adoption. Later, Hansen (1972) suggests the AIDA model which consumers move from an Awareness→Interest→Desire→Action.

**H1-5:** Advertising for new product will have positive effects on perception of product innovativeness.

It is a widely accepted notion that word-of-mouth communication plays an important role in shaping individual's attitude and behaviors (Brown & Reingen, 1987).

Repeatedly, research has shown the importance of consumer word-of-mouth in the formation of attitudes (Bone, 1995). The effects of WOM on the receiver's attitudes have been studied.

**H6:** Word of mouth message about new product will have positive effects on attitude toward new product perception.

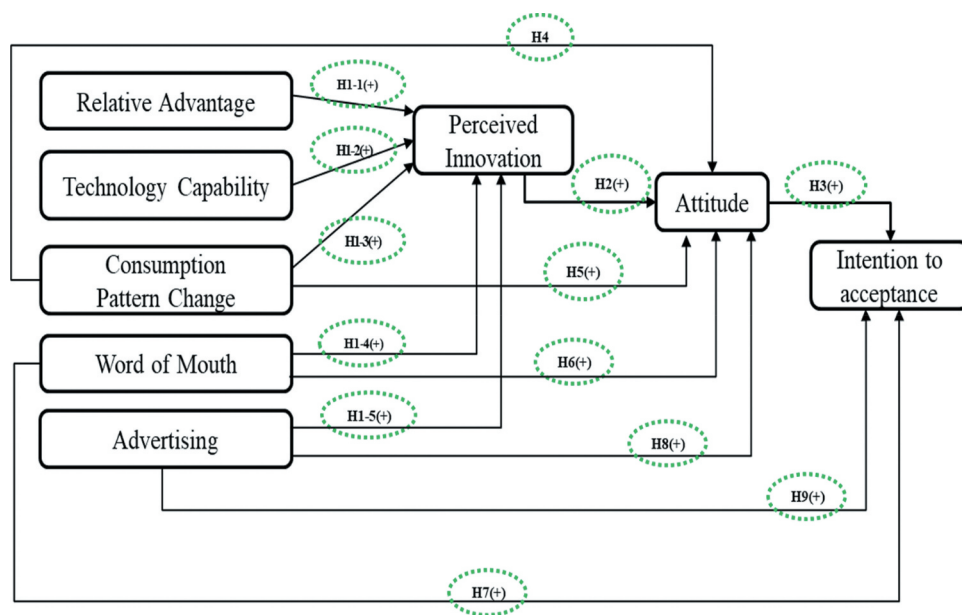
Consumers frequently rely on word-of-mouth when considering the purchasing of a new product or service (Brown & Reingen, 1987). The impact of word-of-mouth on purchase decisions (Seema Pai, 2007) was also supported in this paper. Recently, several researches have started to examine the impact of specific elements of word-of-mouth on consumer choice and purchase decision (Dellarocas et al., 2004; Godes & Mayzlin, 2004b). Consumer attitudes toward advertising in general have long been found to be negative. Zanot (2015), for instance, found that attitudes toward advertising became increasingly negative after the 1970s. Early surveys of consumer attitude revealed somewhat positive results. Gallup found that a majority of respondents liked advertising and found it to be informative. More people held favorable attitudes toward advertising than unfavorable attitudes (Bauer & Greyser, 1968).

**H7:** Word of mouth message about new product will have positive effects on product acceptance.

**H8:** Advertising for new product will have positive effects on attitude toward new product perception.

Advertising is statistically significant on intention to adoption of mobile phone (Adams et al., 1992; Montoya-Weiss et al., 1994; Y. S. Sohn & Ahn, 1997).

**Figure 2. The proposed structural equation model (SEM).**



**H9:** Advertising for new product will have positive effects on product acceptance.

The Research model given in Figure 2 has been established based on all the study hypothesis and theoretical background explained above.

### 3. Empirical analysis

#### 3.1. Data collection and measuring variables

The research process was divided into a number of phases to enrich the findings of this study extensive literature review that was followed by four focus group interviews (FGI) for each country. The goal of focus research was to obtain an in-depth understanding of issues impinging on consumer spending behavior, including the purchase decision process, consumer adoption habits, product acceptance, perception of product innovativeness, and new product perception. The final phase was the quantitative survey to test the hypotheses. The data collected were to measure and test the hypotheses developed. The surveys were administrated by leading research agency after the research purpose was fully explained to the respondents. To test the proposed hypothesis, the author obtained technology evaluation data in China and USA from July 2019 to October 2019. The author has in our dataset a total of 3000 respondents who have knowledge of Samsung Galaxy's new product in the early stage of product launch. The data contain technology evaluation score (7 points interval scale from 1 which is not at all to 7 which is extremely yes). The survey was conducted to sample ranging from 18 to 57 years old including various ages, sex, occupation, education, and income in China and USA. In addition, word of mouth and advertising were included for marketing messages (Y. S. Sohn & Ahn, 1997). The author also collected information on innovation characteristics such as relative advantage, technological capability, consumption pattern change, word-of-mouth, and Advertising. There are no ethical issues with the use of the data because the research was conducted in-house.

The definition of manipulated measurement concept is the following.

In this study, the author proposes an SEM to investigate their perception and attitudes toward smartphone adoption intention. Structural equation model (SEM) has become one of the most

widely used multivariate statistical tools in various areas, such as psychology, education and behavioral sciences (Bentler, 1983; S.Y. Sohn & Moon, 2003). SEM is basically formulated by two types of equations namely, measurement model and structural model. While the measurement models can be used to grasp the relationships between observed variables and latent factors, the structural model can be used to assess the hypothesized relationship among latent factors. MLE (Maximum Likelihood Estimation) and PLS (Partial Least Square) are common tools to estimate SEM. Although the MLE is widely used, it still has limitations since the MLE needs not only distributional assumptions but also a large number of samples. PLS, however, is free from such limitations. The author uses the PLS method to estimate SEM and verify the relationship among the factors. Prior to analyzing an SEM using these data, confirmatory factor analysis was carried out in order to validate the relationship among the measurement variables and latent factors the author set up. The author used Partial Least Squares (PLS) to examine the data with PLS-Graph. PLS is a second-generation multivariate technique that can be used to evaluate the model constructs and to estimate the relationships between the variables. The convergent and discriminate validity of the research instrument were analyzed with PLS. The constructs had high factor loading with greater than 0.80 (Fornell & Larcker, 1981) demonstrating convergent validity. Next, the author evaluates the research model by evaluating the strength of the underlying relationship.

The results are given in Table 1 and reliability of research instrument is often tested by Chronbach Alpha ( $\alpha$ ; Hair et al., 1998). The results show that the Cronbach's  $\alpha$  of all variables were higher than 0.70 which confirms the reliability of relationships among the measurement variables and the latent factors. Thus, it could be concluded that the internal reliability of the questionnaire was acceptable.

PLS also has several advantages to estimate path coefficients in SEM but one can't verify the significance of the path coefficients among latent variables. In order to improve this weakness, bootstrap confidence interval is employed to verify the significance of the path coefficient (Sohn, 1996). Using this method, the significance of the path coefficient between latent factors is verified by the 95% bootstrap confidence interval (S.Y. Sohn & Moon, 2003). The result is given in Table 2.

All path coefficients appear significant at the 5% level except for that between the word of mouth and perceived product innovativeness. However, when 90% bootstrap confidence interval was assessed, this appears significant. Table 2 shows that product benefit, technology capability, and consumption pattern change have significant positive effects on the perception of innovativeness (H1-1, H1-2, H1-3, H1-4, and H1-5). In addition, the perception of innovativeness has a significant effect on attitude for product (H2). Attitude towards product has significant effect on intention of adoption (H3). The level of changes in usage behavior required for new products will have negative effects on attitude towards product (H4). The H4 that consumption pattern change required for new product will directly give negative effects on attitudes towards product was not supported in this research. The H6 and H7 that word of mouth will have positive effects on perception of product innovativeness, product attitudes, and product acceptance was supported. The H8 and H9 that Advertising will have positive effects on attitude toward new product and new product acceptance (Rogers & Shoemaker, 1971) also supported in this research.

Table 2 shows the cross-cultural difference on information communication technology (ICT) in globalized business environments. Based on the results which the author found, all coefficient values have positive values between two latent variables in two countries. Especially, technological capability has a strongly positive effect on the perception of new product in China. In addition, word-of-mouth and perceived product innovativeness have a strongly positive effect on the perception of new product innovativeness in China and USA, respectively. And Word-of-mouth also has strongly positive effect on attitude for new product in China. Table 3 shows that product benefit, technological capabilities, and consumption pattern have all positive effects on the perception of innovativeness in two countries. Attitude toward a product proved to play a mediating role between perception of innovativeness and intention of adoption. In addition,

**Table 1. Confirmatory factor analysis in China and USA**

<b>Latent Variable</b>	<b>Measurement Variable</b>	<b>Factor Loading</b>	<b>Cronbach Alpha Test</b>
Product Benefit	The new phone meets customer needs better	0.99	0.857
	The new phone is better quality than existing product	1.00	
	The new product has a unique feature/attribute compared to existing product	0.97	
Technology capability	The new phone has specialized expert technology	0.96	0.960.991.00
	This new phone technology is cutting edge	0.99	
	This new phone has a high level of technology	1.00	
Consumption pattern change	This new phone can bring change to usual habits	0.98	0.981.00
	This new phone is suitable to the situation/environment of phone usage	1.00	
Perceived product innovativeness	The technology of this new phone is new	0.90	0.901.000.950.89
	The technology of this new phone is different	1.00	
	The technology of this new phone is unique	0.95	
	The technology of this new phone is innovative	0.89	
Attitude for product	The technology of this new phone is appropriate	0.87	0.870.900.91
	The technology of this new phone is beneficial	0.90	
	The technology of this new phone is favorable	0.91	
	The technology of this new phone is likeable	1.00	1.00
Intention of adoption	You have intentions to buy this new phone	0.99	0.991.000.83
	You will consider buying this new phone	1.00	
	You will recommend this new phone to people around you	0.83	
Word of mouth	You easily get word of mouth message about this new phone	1.00	1.00

(Continued)

Latent Variable	Measurement Variable	Factor Loading	Cronbach Alpha Test
Advertising	You often see advertisements for this new phone	0.84	0.84
	You like the message of this new phone advertisement	1.00	
	The advertisements of this new phone is reliable	0.80	

word-of-mouth and technological capability have a positive effect on perception of innovativeness in China. In addition to **H1-1**, the author analyzed direct and indirect effects among the factors in order to find the most influential factors on the overall innovation index. Direct effects are association of one variable with another specified in the model. Indirect effects are association of one variable with another mediated in the model through other variables. Total effect is represented by the sum of direct and indirect effects (K.Y. Kim & Kang, 2001).

As shown in **Tables 4 and 5** in two countries, attitude for product and word of mouth have direct influence on the innovation index while product benefit, technological capability, consumption pattern, and perceived product innovativeness have indirect influence on the innovation index. The results show that it is efficient to control word of mouth factor for improvement of innovation index in a short time. In terms of total effect, China showed the highest in word of mouth. This shows the importance of word of mouth in comparison to the others such as product benefit,

**Table 2. 95% bootstrap confidence interval for path coefficient of the proposed SEM**

Latent variable			Path Coefficient	
			China	USA
Product benefit	→	Perceived product innovativeness	0.184**	0.206**
Technology capability	→	Perceived product innovativeness	0.497**	0.187**
Consumption pattern change	→	Perceived product innovativeness	0.165**	0.354**
		Attitude for product	0.286**	0.146**
Perceived product innovativeness	→	Attitude for product	0.452**	0.566**
Attitude for product	→	Intention of adoption	0.231**	0.374**
Word-Mouth	→	Perceived product innovativeness	0.026	0.169**
	→	Attitude for product	0.586**	0.670**
	→	Intention of adoption	0.571**	0.364**
Advertisement	→	Perceived product innovativeness	0.039**	0.115**
	→	Attitude for product	0.072**	0.158**
	→	Intention of adoption	0.077**	0.216**

\*\* Significant parameters at 5% bootstrap confidence interval

\* Significant parameters at 10% bootstrap confidence interval

**Table 3. Causal relationship between the satisfaction level between two latent variables**

Latent variable	→	Latent variable	Path Coefficient	
			China	USA
Product benefit	→	Intention of adoption	0.019	0.044
Technology capability			0.052	0.040
Consumption pattern change			0.083	0.130
Perceived product innovativeness			0.104	0.212
Attitude for product			0.231	0.374
Word-Mouth			0.157	0.401
Advertisement			0.098	0.299

**Table 4. Latent variables for total effect in China**

Latent variable	→	Latent variable	Direct effect	Indirect effect	Total effect
Product benefit	→	Intention of adoption	0.000	0.034	0.034
Technology capability			0.000	0.096	0.096
Consumption pattern change			0.000	0.127	0.127
Perceived product innovativeness			0.000	0.185	0.185
Attitude for product			0.372	0.000	0.372
Word-Mouth			0.516	0.094	0.610
Advertisement			0.075	0.000	0.075

technology capability, consumption pattern, and perceived product innovativeness, and advertisement.

Regarding age level, overall research results show that technological capability in China and USA, regardless of high (more than 40) or low (less than 20), age has relatively higher positive effect on the perception of innovativeness than in USA. On the other hand, word-of-mouth in USA has a relatively higher positive effect on attitude towards product than in China. In addition, perception of innovativeness and word-of-mouth have a strongly positive effect on attitude towards new product and intention of new product adoption, respectively, regardless of age in two countries.

Table 6 shows the cross-cultural differences on information communication technology (ICT) in globalized business environments. Based on the results which the author found is that word-of-mouth has a positive effect on the perception of new product innovativeness regardless of age in two countries. In USA, especially, word-of-mouth does not have strongly positive effect on attitude towards new product.

#### 4. Managerial implications

Because the factors affecting the adoption of smartphones differ according to respondents, smartphone manufacturers need to develop different strategies to increase smartphone diffusion

**Table 5. Latent variables for total effect in USA**

Latent variable	→	Latent variable	Direct effect	Indirect effect	Total effect
Product benefit	→	Intention of adoption	0.000	0.044	0.044
Technology capability			0.000	0.078	0.078
Consumption pattern change			0.000	0.091	0.091
Perceived product innovativeness			0.000	0.171	0.171
Attitude for product			0.296	0.000	0.296
Word-Mouth			0.466	0.018	0.484
Advertisement			0.157	0.038	0.195

rate among the two countries. First, product development & marketing strategies that emphasizes their smartphone new function will enhance the adoption of smartphone.

Second, R&D and marketing guidelines can help smartphone users in their use.

As the product innovation and word-of-mouth has the most powerful impact on smartphone adoption, user satisfaction about perceived product innovativeness will increase users' overall satisfaction with their smartphones. A strategy to build the R&D investment should be developed so as to increase smartphone's benefit, relative advantage, ease of use, and technology.

Third, continuous improvement in smartphone usage is also a critical impact on the adoption of smartphones by smartphone users. As many current smartphone users are early adopters and early majority, upgrading product usage along with its functionalities will attract such users to adopt the next generation of phones.

Finally, with the changes in the smartphone market, the market is moving more towards service-oriented business. The only alternative for the sustainable smartphone market will be the convergence of products and services. Therefore, more importance on service is required to increase product acceptance.

## 5. Conclusion

This study examines the factors affecting users' adoption of the smartphone as an

innovative device. Among the results of this study, consumption, attitude for product innovativeness, product adoption, and WOM showed a higher response in the USA than in China. But, the results of the technology capability indicated a greater response in China than in the USA. Research results from product benefits and Advertising showed similar response in both countries.

First, this research has modeled the relationship of innovations and product results (product behavior and acceptance intention in customer's point of view) of the new product in customer's point rather than from company's point of view. In other words, while current researches mainly define the innovation level and type of products from company's point of view and examine the market result, this essay modeled from what Veryzer (1998b) proposed; relative advantage point compared to current products, absolute technical superiority, changes in required usage behaviors and etc as 3 decision factors for innovative perception. It positively verified that this proposal of 3 factors give positive effects to innovative perception from the customer's point of view.

**Table 6. 95% bootstrap confidence interval for path coefficient of SEM**

Latent variable		Path Coefficient							
		China				USA			
		All	Less than 20	More than 20	All	All	Less than 20	More than 20	All
Product Benefit	→	0.184**	0.217**	0.159**	0.206**	0.128	0.210**		
	→	0.497**	0.481**	0.528**	0.187**	0.107	0.159*		
	→	0.165**	0.179**	0.154**	0.354**	0.416**	0.361**		
Technology capability	→	0.286**	0.273**	0.303**	0.146**	0.114*	0.165*		
	→	0.452**	0.446**	0.463**	0.566**	0.536**	0.636**		
	→	0.231**	0.250**	0.178**	0.374**	0.374**	0.233**		
Consumption pattern change	→	0.026	0.018	-0.034	0.169**	0.300**	0.131**		
	→	0.206**	0.220**	0.214**	0.670**	0.100	-0.011		
	→	0.571**	0.563**	0.629**	0.364**	0.331**	0.429**		
Perceived product innovativeness	→	0.039**	0.025	0.104**	0.115**	0.081*	0.171**		
	→	0.072**	0.072**	0.040	0.158**	0.173**	0.181**		
	→	0.077**	0.071**	0.116**	0.216**	0.259**	0.343**		
Attitude for product	→								
	→								
	→								
Intention of adoption	→								
	→								
	→								
Word-Mouth	→								
	→								
	→								
Advertisement	→								
	→								
	→								

\*\* Significant parameters at 5% bootstrap confidence interval;

\* Significant parameters at 10% bootstrap confidence interval



Also, by modeling Veryzer (1998b)'s innovation evaluation criteria into leading variable, it was verified that while relative advantage, technology capability compared to the original product influence innovation perception in a similar size, the impact size of the required consumption pattern change is significantly smaller than the two variables. Moreover, contrary to Veryzer (1998b)'s result that the required consumption pattern change gives a positive (+) impact to consumers' perception on product innovation but gives a negative (-) impact on product attitude, this research obtained a result that it gives a positive (+) impact.

Second, the author verified the similarity in relationship between innovative product perception and the product acceptance through acceptance-level model which showed that acceptance intervened with the behavior. In other words, as Gatigon and Robertson (1985) indicated, for highly involved products with big innovation acceptance cost in the customer's point of view, rather than having acceptance right after perceiving the products characteristics, it means acceptance intention happens in order after perceiving the products characteristics and constructing the behavior towards the product.

Third, the size of the perceived innovation is proven to give a positive effect on the product behavior and acceptance intention. But, even though the product innovative perception from the consumer gives a positive effect on the product acceptance intention, after a certain level the acceptance intention doesn't increase proportionately to the size of innovation perception but the size gradually decreases. Practically, for innovative products, the company can lead the market on their own, only if the products released to the market are perceived in the consumers' point of view, form a behavior, and go through a product acceptance process are considered, fact that consumer's point of view for innovative product development and introducing process is important.

Fourth, the two studies (WOM and Advertising) provide consistent support for the proposition that firms should start new product communications with WOM, and then continue with advertising. This strategy generates higher levels of consumer awareness and greater intentions of adopting the new product, compared to starting with advertising. However, nowadays firms can easily promote WOM communication. The internet provides numerous avenues through which to share consumers' views, preferences or experiences with others (Trusov et al., 2009), and companies need to be aware of these. Furthermore, starting a communication strategy with WOM in a new product launch generates product-related WOM. This result is important since the higher the volume of WOM, the faster consumers' adoption of the new product (Shen & Hahn, 2008).

As a conclusion, the results reveal that product benefit, technological capabilities, consumption pattern change and word of mouth have all positive effect on the perception of innovativeness. Attitude toward a product turned out to play mediating role between perceived innovativeness and intention of adoption. In addition, the outcome of this investigation indicated that there were no significant cultural differences between respondents in USA and China in regard to the adoption of a smartphone. The survey results that would provide insight into key factors that affect the evaluation of new products rather than to provide a comprehensive list of correlated with product success. That is very valuable implication for smartphone manufacturers to develop customized R&D and marketing strategies.

## 6. Limitations and future research

Future research should address the limitations apparent in the current study. The author measured information about searching for the new product very early on, at the awareness stage. Some consumers had not yet considered looking for information about the new product at this stage. Thus, it would be interesting to measure this variable at a more advanced stage of new product adoption. To generalize the model on innovation perception factors in consumer's view, additional research needs to apply different products, different countries, and different consumer groups on the research model.

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