Convergence or Divergence?: A Comparison of Acceptance and Use of Technology for Smart Phones and Tablets

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Abstract --The market position of smart phones is similar to that of tablets, since many similar new products co-exist in the market, i.e., the "phablet." Therefore, we applied the Unified Theory of Acceptance and Use of Technology 2 (UTAUT2) model to explore the differences and similarities between smart phones and tablets. Six hundred and seventy questionnaires, including 365 for smart phones and 305 for tablets, were collected. The result shows that these two devices differ in some aspects. For smart phone users, the factors Facilitating Conditions, Price Value, Hedonic Motivation, and Habit affected Behavioral Intention and Use Behavior. For tablet users, the factors Performance Expectation, Hedonic Motivation, and Habit affected Behavioral Intention and Use Behavior. The no significant effects were seen for any moderating variables (i.e., age, gender, experience). Finally, we concluded that mobile device users choose a device on the basis of different needs. People who use smart phones need more software resources and capabilities and tend to compare prices before purchasing a smart phone. However, tablet users tend to consider how the device can help them improve work efficiency or the quality of their daily life. The results can serve as a reference for manufacturers of these devices to improve their products and services.

I. INTRODUCTION

A. The "fuzzy boundary" between smart phone and tablet

In 2011, the company Asus developed a new product. The company conducted a reorganization to combine its mobile phone sector with its tablet computing sector. Thus, Asus launched the first variant phone, called the Padfone, which integrates the functions of smart phones and tablet computers (hereafter referred to as "tablet"). The following year, Apple introduced its 7-inch tablet, the iPad mini, which successfully penetrated the market and rapidly became popular. In the same year, Samsung also introduced its smart phone, Note2. The Note2's screen size is 5.5 inches, which makes the new product more like a tablet. The success of these products shows that consumers will accept smart phones with bigger screens (or tablets with smaller screens). Similarly, by 2013, many tablets had been integrated with telephone functions, e.g., Asus's 7-inch Fonepad (hereafter referred to generically as a "call tablet") and Samsung's Galaxy Tab 7.0. These tablets have 3G telecommunication functions. These new products have blurred the boundary between smart phones and tablets.

B. Research questions

Tablets and smart phones have no dramatic differences in term of hardware specifications (standard), operating systems, software, and functionalities. The similarity of these two products has caused the market position of these two products

to blur. Therefore, we propose the following questions: what will be the boundary of these two devices in the near future? Also, will these two products be integrated as one (i.e., convergence[1]) in terms of user acceptance? This study aims to provide cogent answers to these questions through analyzing consumers' acceptance levels—in the areas of cognition, behavior, and intentions—of these products when they choose these devices. We found that there are limited studies comparing the acceptance of these two products. Thus, we conducted a survey to explore consumer acceptance (i.e., cognition, behavioral intention, and buying behavior) of these two products with a new model proposed by Venkatesh et al [1]. We also compared the acceptance of smart phone users and tablet users to analyze the similarities and differences between these two products. Finally, we propose some suggestions to the industry for the future development of these two mobile devices.

In section 2, we review the literature with which they gathered the major variables of technology acceptance on smart phones and tablets. In section 3, we introduce the concepts and analysis process of the Unified Theory of Acceptance and Use of Technology (UTAUT) models. Sections 4 and 5 present the survey findings and provide conclusions and suggestions, as well as some managerial implications.

II. LITERATURE REVIEW

A. Technology acceptance factors for smart phone

Nowadays, the smart phone has become not only a life necessity but also a fashion product. A smart phone helps people to conveniently communicate and network with others. It also leads more users to become "addicted" to the Internet, i.e., to sites such as Facebook and Line [2]. Oulasvirta et al. [2] pointed out that people who own a smart phone have developed a unique behavior of checking information on their smart phone. When people increase the frequency of use of their mobile phone, it gradually becomes a habit. Such user behavior will lead to new demands on smart phones. Recently, smart phone users have installed applications for Facebook, and Line to support their phone habits. Such behavior has been described as "addiction of using mobile phone."

Kleijnen et al. [3] suggested that consumer acceptance of a mobile phone will depend on his or her perception of the cost, social influence, the quality of its operating system, the user's

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[1] The term divergence would be used if the two devices kept developing along parallel tracks.

age, technological skills, information available about smart phones, and the availability of information technologies; these factors will directly or indirectly influence a person's decision to acquire and use a smart phone. The conditions of whether a consumer has sufficient capabilities and resources (Facilitating Conditions) and whether a product is affordable and plausibly priced for users (Price Value) will also influence the consumer's intention (Behavioral Intention) to purchase a mobile phone.

Although mobile phones have been commercially available for many years, the smart phone has become successful only recently. Now, smart phones are rapidly taking the place of ordinary mobile phones. This aroused our curiosity: Will smart phones also become a substitute for tablets depending on the user's technology acceptance? We argue that this is an essential research gap in studies of smart phones.

B. Technology acceptance factors for tablet

The concept of a tablet product was introduced in 2000, and Microsoft launched the first tablet in 2001. A tablet has a lightweight touch-sensitive screen and a pivotable display, among other features; thus, it is easy to carry and fashionable. The tablet has gradually taken the place of notebook computers in recent years. In particular, in 2010, Apple introduced the iPad, which integrated the functions of an electronic reader, a digital photograph display, and a mobile Internet device and was priced at $US499. Therefore, the iPad provided not only better functions and features but also a lower price than a notebook. The iPad triggered rapid growth of tablets, accelerating the replacement of notebooks.

Anderson et al. [4] used the UTAUT model to survey college students about technology acceptance with tablets. They found that the factor of Performance Expectation (users believe the device can help them to increase their working performance) had a significant positive impact on Behavioral Intention but it had less impact on such variables as Effort Expectancy (the level of effort it takes users to use the device), Social Influence (users use the device because others use it), and Facilitating Conditions. The authors suggested that Performance Expectation is the most important reason for customers to adopt a tablet, with the moderating influence of user age. With an increase in user age, Behavioral Intention declines. Obviously, this finding suggested that the majority of tablet users are younger.

El-Gayar et al. [5] mentioned that tablets are lighter in weight; this increases their mobility and the frequency of use. Therefore, the tablet has attracted tremendous numbers of users in various areas, e.g., health care, commerce, government, and education. The authors found that the variable of Social Influence affected the level of Effort Expectancy, and it had a significant and positive moderating effect on the acceptance of a tablet. Furthermore, Social Influence was a significant influencing factor in the acceptance of a tablet. For example, students were likely to be influenced by others in the decision to buy and use a tablet. Even among experienced tablet users, Social Influence

affected Behavioral Intention and Use Behavior. Meanwhile, the variable of Facilitating Conditions had a positive impact on the acceptance of a tablet, i.e., the early provision of supportive services led more users to buy and use a tablet.

The tablet market has begun to flourish in recent years. To date, most published studies have investigated the functionality and social issues associated with notebooks and early tablets. However, there is limited information on the consumer's technology acceptance of tablets. Thus, we argue that this is another gap in tablet research.

C. The Unified Theory of Acceptance & Use of Technology Model 2 (UTAUT2)

Since the introduction of the UTAUT by Venkatesh in 2003 [6], the model has been discussed and modified by many researchers in information technology. In 2012, Venkatesh et al. [1] proposed a new version, called the Unified Technology Acceptance and Use of Technology 2 model (UTAUT2). The authors added a linkage between Facilitating Conditions and Behavioral Intention to the UTAUT2 model (see Figures 1 & 2), and they proposed several new variables, including Hedonic Motivation (users feel that it will make them happy to use the device), Price Value, and Habit (users' almost unconscious use of the device). Meanwhile, Venkatesh et al. [1] found that Voluntariness had little effect on the likelihood of use of an information and communication technology device; thus, they deleted Voluntariness as one of the moderators in the new model[2].

Table 1 shows the key variables and literature related to the technology acceptance of two types of mobile devices—smart phones and tablets—and how these variables are associated with the UTAUT2 model.

III. METHOD

This study focuses on exploring what factors lead consumers to purchase and use a smart phone or a tablet. In particular, we hope to determine the similarities and differences in the acceptance of the two devices to obtain some useful suggestions for scholars and practitioners for further work. Based on the literature review, we considered the following relevant factors of two devices and the UTAUT2 model when designing our questionnaire.

A. Variables

In our questionnaire design, we included following nine factors: Performance Expectation, Effort Expectancy, Social Influence, Facilitating Conditions, Hedonic Motivation, Price Value, Habit, Behavioral Intention, and Use Behavior (users did purchase the device). Furthermore, we also included three moderators proposed by Venkatesh et al. in our questionnaire design: Gender, Age, and Experience.

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[2] Venkatesh et al. considered that consumers use information and communication technology devices by their own intention (voluntarily) but that this use is enforced by an organization, i.e., office automation system.

TABLE 1. THE KEY VARIABLES OF TECHNOLOGY ACCEPTANCE FOR SMART PHONE AND TABLET

Category	Literatures	PE	EE	SI	FC	HM	PV	HA	BI	UB
Smart phone	Oulasvirta [2]							○	○	○
	Lee et al. [7]***		○	○					○	○
	Kleijnen et al. [3]**		○	○	○		○		○	
	Roberts [8]**				○					
	Kwon and Chidambaram [9]**		○	○					○	○
Tablet	Anderson et al. [4]	○	○	○	○				○	○
	El-Gayar, Moran & Hawkes [5]	○	○	○	○				○	○
Technology acceptance model (UTAUT2)	Venkatesh et al. [6]	○	○	○	○				○	○
	Venkatesh et al. [1]	○	○	○	○	○	○	○	○	○
	Vallerand * [10]					○				
	Holbrook and Hirschman * [11]					○				
	Dodds et al. * [12]						○			○
	Kim and Malhotra * [13]							○	○	○
	Limayem et al. [14]*							○	○	○
	Brown and Venkatesh [15]*					○			○	○
	Thong et al [16]*					○			○	○
	Childer et al. [17] *					○			○	○
	Zeithaml [18]*						○			
	Ajzen and Fishbein [19]*							○	○	○

*Cited by Venkatesh et al. [1] [6]; **collected from literature on mobile phones; ***collected from literature on mobile networks.
Notation: **PE**=Performance Expectation, **EE**=Effort Expectancy, **SI**=Social Influence, **FC**=Facilitating Conditions, **HM**=Hedonic Motivation, **PV**=Price Value, **HA**=Habit, **BI**=Behavioral Intention, **UB**=Use Behavior.

B. Questionnaire design

The questionnaire was designed with the aforementioned nine factors and three moderators; a seven-point Likert scale was applied. The survey is divided into two parts: smart phone and tablet. There are 28 questions in our survey, and for each of the nine factors, we designed 3 or 4 questions.[3]

C. Data collection

The target testers of this study were smart phone or tablet users. Because most users of both devices are young, the Bulletin Board System (BBS) was considered as a viable and reliable source for conducting an online survey. The BBS gathers a large number of users, e.g., the PPT (the leading site of BBS) of National Taiwan University (telnet://ptt.cc), and most of them are young people. In addition, the penetration rate of handheld devices in Taiwan is very high[4]; thus, most of these people are smart phone users. To ensure the reliability and effectiveness of our samples, we collected data from the major discussion boards for mobile devices: MobileCom and Mac. Furthermore, we focused on testers who have experience with both devices. Therefore, the accuracy of our comparison of smart phones and tablets can be assured.

C. Analysis

This study used SPSS 20.0 and AMOS 20.0 for statistical analyses and to test the hypotheses (refer to Figures 1&2). We conducted descriptive statistical analysis, reliability analysis, and linear regression analysis with SPSS 20.0, and AMOS 20.0 was used to conduct the confirmatory factor analysis.

IV. RESEARCH RESULTS

A. Data collected

We conducted the survey between January 4 and January 31, 2013. In all, 670 valid questionnaires were collected; 365 surveys for smart phones and 305 for tablets were completed. About 90% of the testers had at least a college-level education. The testers' monthly income was less than 20,000 NT dollars (about US$700). Not surprisingly, the majority of users were young people, ages 21 to 25 years. They all had experience in using smart phones and tablets.

B. Reliability and validity

The Cronbach α of each factor was over 0.7, and most were above 0.8. Therefore, the data can be considered to have good reliability. Meanwhile, the square roots of inter-factors' AVE (Average Variance Extracted) values were all greater than the correlation coefficients between factors. Therefore, these data have good discriminant validity.

C. Moderators

The three moderating factors of Gender, Age, and Experience were originally proposed by Venkatesh et al. in their UTAUT2 model. Thus, we also included these

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[3] We referred to the questionnaire of Venkatesh et al. to design our survey, and we modified some questions to make them suitable for either a smart phone or a tablet.

[4] According to a survey conducted by III (Institute for Information Industry), Taiwan is ranked in the top 10 in the world for the number of handheld devices per capita. For example, the cellular phone penetration rate is above 102%.

moderators in our analysis. However, the result of the analysis showed that these factors were not significant. The reason for this is that the majority of the testers were young people with similar characteristics in term of age and experience (and gender, as mentioned). Therefore, it was unnecessary to analyze these factors further.

D. Hypothesis testing

The results of our regression analysis of smart phones and tablets are provided in Figures 1 and 2. The results confirmed some hypotheses, except for the relationship between Behavioral Intention and Use Behavior.[5] It also shows that each device has some unique qualities. We will summarize the findings of our analysis in section 5.

1. The regression analysis for smart phones
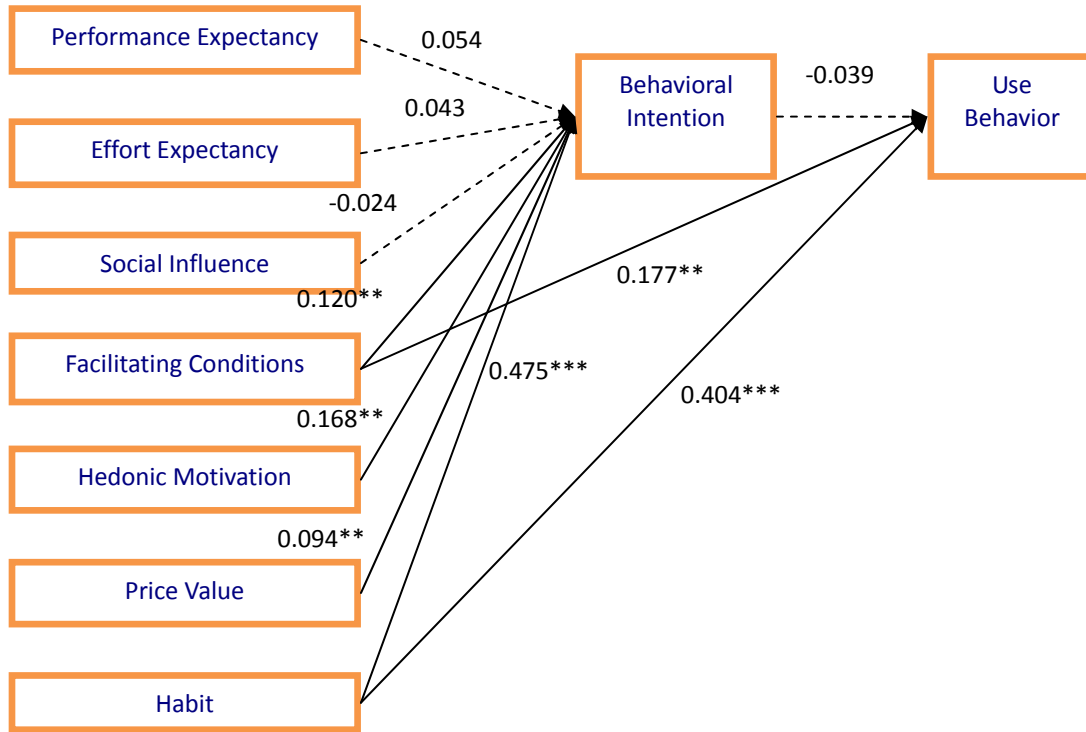
註： *=P<0.1，**=P<0.05，***=P<0.001

Figure 1. Analytical results for smart phone survey

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[5] According to UTAUT2 model, Behavioral Intention has a positive effect on Use Behavior. However, we failed to confirm such a relationship in this study. However, this was the result of including too few variables in Use Behavior. In our confirmatory factor analysis, we deleted some factors, which eventually resulted in Use Behavior showing a lack of significance. We suggest that scholars explore and include more variables in Use Behavior to avoid similar problems in their studies.

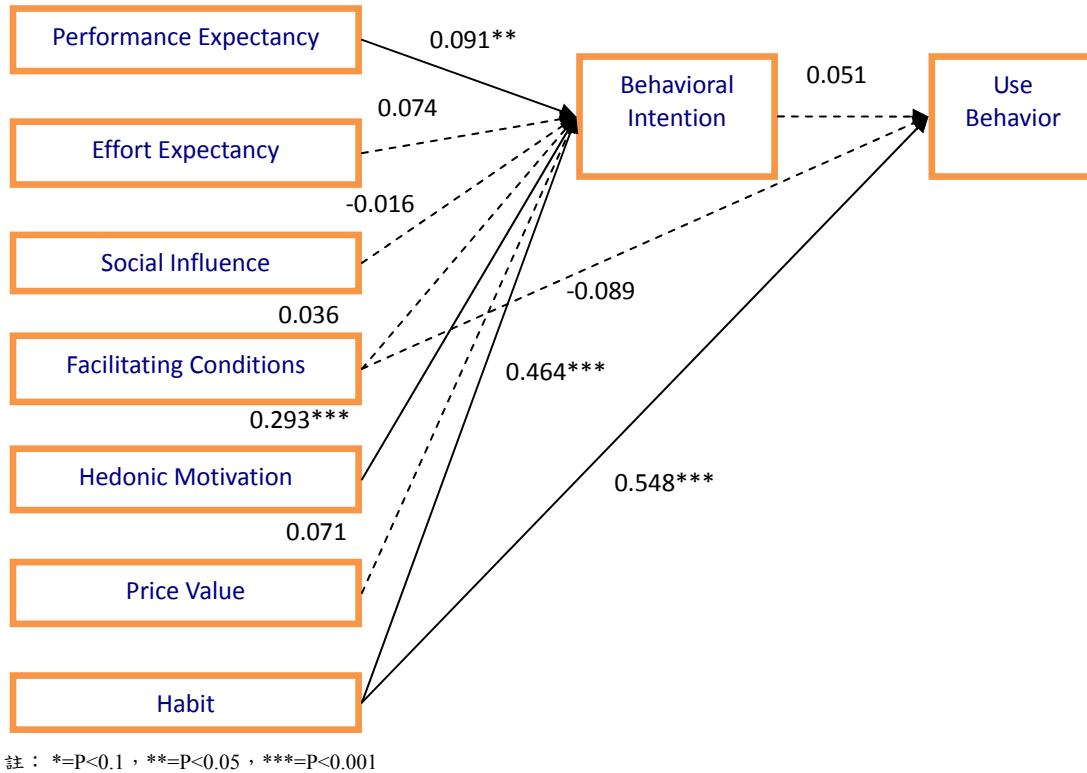## 2. The regression analysis for tablets

註： *=P<0.1，**=P<0.05，***=P<0.001

Figure 2: Analytical result for tablet survey

V. CONCLUSIONS AND SUGGESTIONS

A. Conclusions

1. **Smart phone users stressed "Facilitating Conditions"**

A comparison of Figures 1 & 2 shows that the factor of Facilitating Conditions affected Behavioral Intention and Use Behavior for smart phone users but not for tablet users. This phenomenon can be explained by the fact that the users of smart phones need more resources and/or technological abilities to support their use of smart phones. For example, a smart phone user requires a chip card (SIM card) to enable his/her smart phone, but a tablet user may not need a chip.[6] When smart phone users purchase a mobile phone, they can choose to purchase an empty device (with an existing phone number) or a discount package (with a new phone number). Furthermore, smart phone users will consider the rates for phone calls and Internet use, the cost of the phone, any requirements for prepayments (deposits), and even the stability of the signal before they buy a smart phone. These conditions eventually increase the complexity of mobile phones for users. In contrast, a tablet buyer must consider only whether there are available wireless environments to support their use of the tablet.

2. **Tablet users emphasized "Performance Expectation"**

According to the analysis, tablet users emphasized Performance Expectation, but this did not apply to the users of smart phones (see Figures 1 & 2). This result is consistent with the findings of a study conducted by Anderson et al. [4]. To confirm the findings of this study, we consulted with an expert in the industry. We concluded that smart phones have made improvements in their hardware and software; however, they still fail to provide the convenient file browsing and editing functions that are provided by notebooks. The tablet computer was originally developed from notebook computers. Thus, it has a variety of features and functions, including a foldable body, a rotatable display, and extendable accessories, among others. In addition, a tablet has a larger screen, a long-lasting battery, and multiple fonts. Thus it is a more suitable tool for document work, e.g., reading, browsing, editing, etc. As a consequence, a tablet appears to be more suited for documentation work than a smart phone.

3. **Smart phone users accentuated "Price Value"**

Compared to tablet users, smart phone users paid more attention to Price Value. We believe this is because smart phones have a wide range of prices, with a large span of product categories as well as a longer product chain. However, there are relatively more vendors of smart phones, and thus the market is more competitive. As a result, users of smart phones will carefully note any price differences among their options to

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[6]The Taipei government offers ubiquitous services to mobile device users in certain parts of the city.

TABLE 2 THE FACTORS AFFECTING TECHNOLOGY ACCEPTANCE OF DIFFERENT MOBILE DEVICES

Hypotheses	Smart phone	Tablet	Result
Performance Expectation→Behavioral Intention		✓	Different
Effort Expectancy→Behavioral Intention			Similar
Social Influence→Behavioral Intention			Similar
Facilitating Conditions→Behavioral Intention	✓		Different
Hedonic Motivation→Behavioral Intention	✓	✓	Similar
Price Value→Behavioral Intention	✓		Different
Habit→Behavioral Intention	✓	✓	Similar
Facilitating Conditions→Use Behavior	✓		Different
Habit→Use Behavior	✓	✓	Similar
Behavioral Intention→Use Behavior			Similar

Note: check "✓" stands for significant level P<0.05.

make comparisons. Smart phone users pay more attention to the value/price ratio. This situation may also explain the rapid growth of "white brand" or "copycat" smart phones in many places. However, this phenomenon simply reflects the fact that many consumers want to buy a smart phone that has a lower price.

IV. COMPARISON

The results of our comparisons are shown in Table 2. There were considerable differences in the technology acceptance of smart phone users and tablet users. Because of these differences, if the current situation remains as it as in the near future, we cannot conclude that those two devices are certain to be integrated as one. Based on feedback from the expert we consulted, the current boundary of two devices will remain as it is, in the sense that the screen sizes of the two devices are still different. Furthermore, the two devices have different supply chains and accessories, and their functions are somewhat complementary. So it is very dubious to state that one of these two devices will replace the other in the future, and there is no evidence to show that smart phones and tablets will be integrated into a single device.

V. SUGGESTIONS

A. Key acceptance factors for smart phone

Based on the present research results, we suggest that smart phone suppliers should improve the Facilitating Conditions of acquiring a smart phone; hence, they should simplify the procedure of buying a smart phone, which may stimulate purchases. With regard to the effect of Price Value, the hardware and software resources and the capabilities of the device are important to smart phone users, who are particularly concerned about the price of a smart phone. To increase user acceptance of smart phones, manufacturers should consider cooperating with relevant resource providers to maximize the value/price ratio and minimize prices.

B. Key acceptance factors for tablet

According to the present study, "Performance Expectations" were more important for tablet users than for smart phone users. To maintain this advantage and to highlight the differences in the markets for these devices, new tablets should provide higher performance, e.g., the ultra-mobile computer, which is like a tablet equipped with a desktop operating system and is similar to a traditional tablet, such as Microsoft's Surface Pro. If future tablets provide better supporting peripherals and a better operating system, they will help users to improve their working performance (and entertainment), and we believe that they may attract new users. Furthermore, if consumers tend to use the device more frequently for their work and if this eventually becomes habitual, the Use Behavior of consumers will be also stimulated.

C. Limitations and suggestions

In this study, we measured only testers in PPT of Taiwan. This study would have provided more valuable information if we had collected responses from a larger sample, both domestically and internationally. This would have allowed us to compare the differences between these two devices in different regions with different users and a variety of use conditions. Such an analysis would provide more insight to the manufacturers of smart phones and tablets so that they could design better products and new services for more people. Furthermore, a comparison of these two devices should be made from time to time so that we can observe the actual changes and trends of users' technology acceptance toward smart phones and tablets. With this information, manufacturers may generate more radical innovations for mobile devices in the future.

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