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Android smartphone adoption and intention to pay for mobile internet: Perspectives from software, hardware, design, and value

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# Android smartphone adoption and intention to pay for mobile internet

## Perspectives from software, hardware, design, and value

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**Abstract**

**Purpose** – The research goal of this study is to explore the factors influencing the adoption of Android smartphones and the intention to pay for mobile internet services.

**Design/methodology/approach** – The present study proposes a framework based on theory of reasoned action (TRA) from the perspectives of software (interface convenience and perceived content), hardware (perceived infrastructure), design (design aesthetics) and perceived value (emotional value, price/value for money, performance/quality value, and social value). A web survey was conducted, and data were collected from a total of 881 users of Android smartphones in Taiwan. The casual model was validated using partial least squares (PLS) techniques.

**Findings** – The results indicated that the influence of the factors on the intention of the mobile internet users and non-users were different. Surprisingly, the effect of design aesthetics was not significant in all of the groups. Male users were found to be more likely to read e-books on their smartphones, as are people with higher personal incomes.

**Practical implications** – This study contributes to a theoretical understanding of the factors that promote mobile internet users' and non-users' intention to adopt Android smartphones and pay for mobile internet services. The proposed framework can be used by mobile internet service providers and smartphone manufacturers to design the products and marketing strategies.

**Originality/value** – The primary value of this paper lies in providing a better understanding of users' and non-users' concerns about Android smartphone adoption and subscription of mobile internet services.

**Keywords** Smartphone, Android, Mobile internet, Perceived value, E-books, Theory of reasoned action, Communications, Mobile technology, Taiwan

**Paper type** Research paper

## 1. Introduction

With the development of mobile internet services, more and more consumers are adopting smartphones as their primary communication device. Worldwide smartphone sales to end users reached 115 million units in the third quarter of 2011, up 42 percent from the third quarter of 2010 (Gartner, 2011), with most based on Android, Symbian, Windows Mobile, and iOS operating systems. In particular, Google's Android, which is available on all carriers for a wide range of handsets from multiple manufacturers, accounted for 50.9 percent of the worldwide market in 4Q2011 (Gartner, 2012).

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A smartphone offers more advanced computing ability and connectivity than a feature phone, and typically includes a high-resolution touch screen and offers wireless-internet access to web pages through a built-in web browser. Telecommunication companies have recently begun to promote smartphone products in hopes of promoting mobile internet services as a way to increase revenues. While Android mobile devices account for over half of the market for smartphones, Android users only accounted for a 16 percent share of the mobile internet market in 2011 (Elmer-DeWitt, 2012). Thus, telecom service providers have a strong interest in exploring ways to increase user intention to use mobile internet through Android devices.

Recently, several studies have explored motivation for adopting smartphones and mobile internet from a variety of perspectives, such as technology acceptance model (TAM), aesthetic design, and perceived value (Cheong and Park, 2005; Kim *et al.*, 2007; Park and Chen, 2007). However, few of these studies have specifically investigated Android smartphones in mobile internet context, which are relatively new to the market. Android is an open source system which allows manufacturers to customize their devices, including hardware and software (Android developer, 2012). Consequently, one of our research purposes is to investigate the influence of hardware- and software-related factors on adoption intention.

Moreover, perceived value is the main determinant of payment intention (Kim *et al.*, 2007). Mobile internet services feature a range of value added services, such online music and mobile shopping. Many publishers also are collaborating with telecommunication companies to provide online e-book services for mobile devices, and people are increasingly using Android devices to read books online. For example, university students were found to be willing to adopt mobile library services through mobile devices (Paterson and Low, 2011). Nevertheless, personal differences (e.g. age, gender, and educational level) may influence adoption and usage patterns of various information technologies (Zhang and Ma, 2011). Therefore, this study explores the effects of perceived values on user intention to purchase mobile internet services and to determine correlations between demographic differences and e-book reading behavior on Android devices.

## 2. Conceptual framework and hypothesis development

Figure 1 presents this study's research model, developed based on the theory of reasoned action (TRA). According to Ajzen and Fishbein (1980), the intention to perform a particular behavior is mainly determined by a personal factor (e.g. an individual's attitude) and a social factor (e.g. a subjective norm). TRA has been used as the basis of several information system (IS) acceptance models, including web site usage (Lu and Lin, 2002) and e-banking (Ramayah *et al.*, 2009). TRA is a general model, which does not specify beliefs about a particular behavior. Hence, researchers need to consider other salient beliefs when adapting TRA to explain different adoption behaviors. From its initial release, Android has been constantly improved either in terms of features or supported hardware, and has been extended to an expanding range of devices. Android's open and customizable architecture allows manufacturers of Android devices to develop their hardware and software specifications with features designed to appeal to users and achieve market advantage (Gandhewar and Sheikh, 2010). Hence, the research model in the study considers hardware, software, and design aesthetics as the main determinants of attitude.

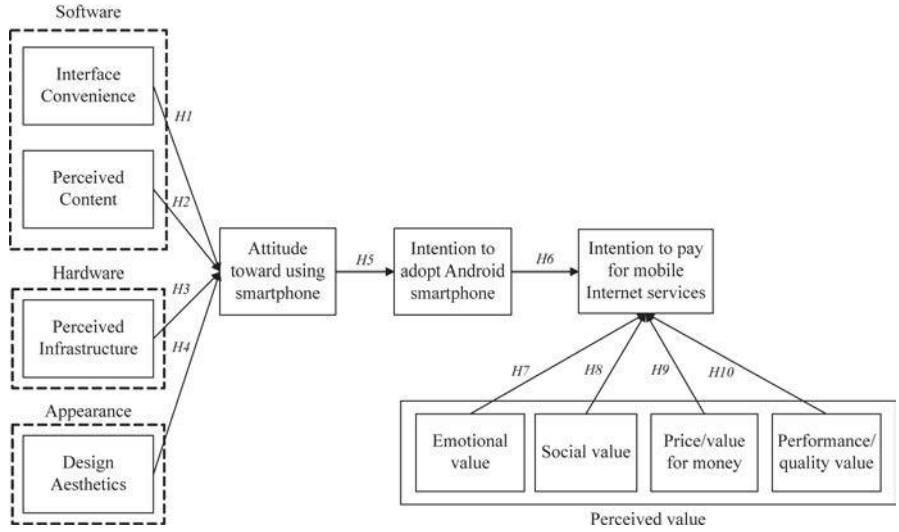


**Figure 1.**
Research model

The customizable nature of Android allows manufacturers of Android devices to develop functions and interfaces to satisfy the needs of their customers, primarily to offer differentiation through content and interface convenience (Lin, 2007; Kim *et al.*, 2008; Nanda *et al.*, 2008). Android's infrastructure provides support for additional hardware, such as accelerated 3D graphics, dedicated gaming controls, USB flash drives, and USB hard disks. This infrastructure is an important hardware factor for user attitudes toward Android devices. Furthermore, previous studies have indicated user emotional reaction and product preferences are influenced by the product's aesthetic design (Nanda *et al.*, 2008). Thus, the model also includes aesthetic design as a key determinant for attitude.

Perceived value has been recognized as an important determinant of user intention to adopt new technologies (Sweeney and Soutar, 2001; Kim *et al.*, 2007; Hsiao, 2011). Perceived value is the consumer's overall assessment of the a product or service's utility as determined by the consumer's perception of what is received and given; it can be enhanced by either increasing benefits of the product/service or by decreasing the expense of purchasing and using it. Sweeney and Soutar (2001) proposed an approach to evaluate perceived value based on four aspects: emotional value, social value, quality value, and cost value. Hence, this study proposes that these four values influence user intention to purchase mobile internet services. This study's research model proposes ten hypotheses, which are described in detail below.

*Interface convenience*

In this study, interface convenience is defined as the extent to which an individual believes that Android systems provided by manufacturers would provide an easy and efficient means of user–system interaction (Kim *et al.*, 2008). Chang and Chen (2008) indicated that interface quality will influence the user's affect. In studying mobile internet services, Chae *et al.* (2002) demonstrated that quality of user–system interface can enhance user satisfaction and loyalty. Therefore, it is anticipated that increased

convenience and ease of use would positively affect user attitudes toward Android devices. Thus, *H1* is stated as follows:

*H1.* Interface convenience will positively affect user attitudes toward Android devices.

*Perceived content*

Functions are anticipated to play an important role in Android, because the functions or software provided by manufacturers would improve operation efficiency. Perceived content can be defined as the user's perception of the quality (usefulness) of a smartphone's features provided (Davis, 1989; Lin, 2007). Lin (2007) indicated that perceived content would increase positive attitudes towards adopting a smartphone, while Laurs (2009) found that embedded content is a major driver for mobile phone purchases. Thus, it is anticipated that perceived content will enhance users' attitudes toward Android devices. *H2* is stated as follows:

*H2.* Perceived content will positively affect user attitudes toward Android devices.

*Perceived infrastructure*

Perceived infrastructure can be defined as the user's perception of the efficiency provided by the smartphone hardware (Lin, 2007). Android provides a range of hardware supports, such external storage, accelerated 3D graphics, and proximity and pressure sensors. This additional hardware support can help the manufacturers develop specific functions to assist their users in dealing with common tasks, providing users with a range of device specifications to meet their various needs. Past research has also indicated that device hardware spec can influence user feelings about quality and interactivity. For example, Park *et al.* (2011) demonstrated that hardware support for motion feedback can improve the interactivity of a mobile device and significantly influence the affective quality. Thus, it is anticipated that perceived infrastructure will enhance user attitudes toward Android devices. *H3* is stated as follows:

*H3.* Perceived infrastructure will positively affect user attitudes toward Android devices.

*Design aesthetics*

Design aesthetics have been found to be important for user acceptance of technology (Cyr *et al.*, 2006; Nanda *et al.*, 2008). Design aesthetics in this study refers to the balance, emotional appeal, or aesthetic of a smartphone which may be expressed through color, shape, or animation (Cyr *et al.*, 2006). Human visual sense is a key influence on cognition and thus emotion, thus aesthetically pleasing design is an crucial factor to strengthen user emotional attachment to a particular device (Lindstrom, 2005). Nanda *et al.* (2008) suggested that the aesthetic design of mobile phones has an impact on users' emotional reaction, while Cyr *et al.* (2006) found that visual design aesthetics significantly impacted perceived enjoyment. Similarly, it is anticipated that design aesthetics will enhance user attitudes toward Android devices. *H4* is stated as follows:

*H4.* Design aesthetics will positively affect user attitudes toward Android devices.

*Attitude*

Attitude is seen as an important factor influencing user intention for technology adoption (Cheong and Park, 2005; Lin, 2007; Park and Chen, 2007) and, in this case, can be defined as the user's favorable feeling towards an Android smartphone (Nicholson *et al.*, 2001). Park and Chen (2007) found that behavioral intention to use smartphones was largely influenced by attitude toward the technology, while Cheong and Park (2005) found similar results in regards to mobile internet usage. Lin (2007) found that attitude positively influences user intention to continue to use various web sites (Lin, 2007). Therefore, the following hypothesis is proposed:

*H5.* User attitude toward Android devices has a positive impact on their intention to adopt Android smartphones.

*Intention*

A smartphone's functionality may change its user's behavior and intention to purchase mobile internet services. The majority of smartphone owners have been found to be willing to pay for applications and content (Kaneshige, 2010). Many Android devices support mobile internet access and are sold with pre-installed online services, such as e-mail, mapping and search clients. Therefore, the intention to adopt Android devices will have a positive impact on the intention to use and pay for mobile internet services. Hence, the following hypothesis is proposed:

*H6.* User intention to adopt an Android smartphone has a positive impact on the user's intention to pay for mobile internet services.

*Perceived value*

Perceived value is seen as an important factor in purchase intention (Kim *et al.*, 2007; Lu and Hsiao, 2010; Hsiao, 2011) and is defined as an evaluation of the purchaser/user's perception of the benefit provided by a given product/service. This value can be increased either by enhancing the benefits provided or reducing the price demanded (Lovelock and Wirtz, 2007).The value measures for perceived value include emotional value, social value, price/value for money, and performance/quality value (Sweeney and Soutar, 2001). For the purposes of this study, these dimensions are defined as follows:

(1) *Emotional value*. The utility derived from the feelings or affective states that are generated by the product/service of mobile internet services.

(2) *Social value.* The utility derived from mobile internet in enhancing social self-conceptualization.

(3) *Price/value for money*. The utility derived from mobile internet services due to the reduction of its perceived short-term and long-term costs.

(4) *Performance/quality value*. The utility derived from the perceived quality and expected performance of mobile internet services.

Sweeney and Soutar (2001) found these four values directly influence consumer intention to buy, while Lu and Hsiao (2010) found they affect internet users' intention to pay for premium services offered by social networking sites. Thus, it is anticipated that

the four values will increase user intention to pay for mobile internet services as well. *H7-H10* are proposed as follows:

*H7.* Emotional value has a positive impact on intention to pay for mobile internet services.

*H8.* Social value has a positive impact on their intention to pay for mobile internet service.

*H9.* Price/value for money has a positive impact on intention to pay for mobile internet services.

*H10.* Performance/quality value has a positive impact on intention to pay for mobile internet services.

## 3. Research methodology

*Participants*

This study focuses on Android smartphone users in Taiwan. In the Asia-Pacific region, Taiwan's smartphone penetration rates are very high, with only South Korea, Hong Kong, Singapore, Japan and Australia having higher smartphone ownership rates (WantChinaTimes.com, 2012). Across all markets, smartphone usage is more prevalent among younger, male and better educated groups (thinkinsights with Google, 2012). One in two online consumers use a Smartphone in Taiwan, with Android holding a 71 percent market share of smartphone operating systems (Canalys.com, 2012).

*Instrument development*

An online questionnaire featuring 35 self-reporting items was designed to collect responses from Android smartphone users. Most of the items measuring the constructs for the ten hypotheses were adapted from previous studies and were slightly modified to fit the smartphone context. The items for the intention to purchase mobile internet services and to adopt smartphones were respectively adapted from Lu and Hsiao (2010) and Venkatesh and Davis (2000) to fit the context of this study. Perceived content and perceived infrastructure were assessed based on the scale developed by Lin (2007). Interface convenience was assessed based on the scale proposed by Kim *et al.* (2008). Design aesthetics was adapted from Cyr *et al.* (2006). Attitude toward smartphone use was assessed based on items taken from Nicholson *et al.* (2001).The measures for perceived values were adapted from the scales developed by Sweeney and Soutar (2001). All items were measured on a five-point Likert scale ranging from "disagree strongly" (1) to "strongly agree" (5).

A pre-test and pilot test were conducted to validate the questionnaire items. The pretest invited two smartphone experts to assess the logical consistency, ease of understanding, question sequence and contextual suitability of the items. Ten people who had been using Android smartphones for at least one year were invited to evaluate the wording of the items. Their comments resulted in a few minor changes to the wording and sequence of the questions, with the revised questionnaire presented in the Appendix.

*Data collection for model testing and demographics*

Announcements about the online questionnaire were posted on web sites and bulletin board systems featuring smartphone-related activities in Taiwan. Potential

respondents were incentivized to participate by the opportunity to win gift certificates in a lucky draw. Responses were gathered from February 1 to March 31, 2012. To prevent duplicate submissions, respondent identities were checked by their e-mail and IP address on receipt of the questionnaire. An initial total of 957 responses were collected, of which 76 were either incomplete or duplicates, leaving 881 valid responses. Of the valid respondents, 30 percent were female, and 68 percent were between 20 to 29 years of age. About 45 percent of respondents were current university undergraduates. The demographic profile of the sample is given in Table I.

| Measure | Items | Frequency | Percent |
|---|---|---|---|
| Smartphone usage experience | About 1 year | 677 | 76.84 |
| | About 2 years | 168 | 19.07 |
| | About 3 years | 30 | 3.41 |
| | About 5 years | 5 | 0.57 |
| | Over 5 years | 1 | 0.11 |
| Display size of your smartphone | Under 3 inch | 40 | 4.54 |
| | 3.1 ~ 3.5 inch | 230 | 26.11 |
| | 3.6 ~ 4 inch | 257 | 29.17 |
| | 4.1 ~ 4.5 inch | 283 | 32.12 |
| | Over 4.6 inch | 71 | 8.06 |
| Reading e-books through smartphone | Never | 72 | 8.17 |
| | Seldom | 313 | 35.53 |
| | Often | 324 | 36.78 |
| | Usually | 123 | 13.96 |
| | Always | 49 | 5.56 |
| Gender | Male | 624 | 70.83 |
| | Female | 257 | 29.17 |
| Age | Under 19 | 84 | 9.53 |
| | 20 ~ 29 | 599 | 67.99 |
| | 30 ~ 39 | 166 | 18.84 |
| | 40 ~ 49 | 24 | 2.72 |
| | Over 50 | 8 | 0.91 |
| Education level | Junior high school or less | 9 | 1 |
| | High school | 77 | 8.74 |
| | Undergraduate | 589 | 66.86 |
| | Graduate degree | 206 | 23.38 |
| Income | Under 15,999 | 404 | 45.86 |
| | 16,000 ~ 25,999 | 124 | 14.07 |
| | 26,000 ~ 35,999 | 161 | 18.27 |
| | 36,000 ~ 45,999 | 98 | 11.12 |
| | 46,000 ~ 55,999 | 66 | 7.49 |
| | 56,000 ~ 65,999 | 15 | 1.70 |
| | Over 66,000 | 13 | 1.48 |
| Frequency of using mobile (3.5G) internet | Never | 114 | 12.94 |
| | Seldom | 298 | 33.83 |
| | Often | 469 | 53.23 |

**Table I.**
Profile of respondents

*Data analysis*

The proposed model and hypotheses were tested using partial least squares (PLS) analysis. As in structural equation modeling (SEM), the PLS approach allows researchers to simultaneously assess measurement model parameters and structural path coefficients. Compared to SEM, PLS makes minimal demands in terms of sample size to validate a model (Chin *et al.*, 2003). Unlike covariance-based SEM, PLS focuses on maximizing the variance of the dependent variables explained by the independent ones rather than reproducing the empirical covariance matrix (Haenlein and Kaplan, 2004). The advantages of PLS are that it imposes minimal restrictions on measurement scales, sample size, and residual distributions (Chin *et al.*, 2003). In our model, all items are viewed as the effects (rather than causes) of latent variables, thus they are modeled as reflective indicators. Given the relatively small sample size ($N_{non-user} = 114$), the respondents are classified into different groups according to their experience using mobile internet services.

## 4. Results

*Measurement model*

Convergent validity and discriminant validity were calculated to assess the measurement model. Reliability of the reflective measures was examined by checking the standardized loadings of each item. The minimal indicator-construct loading in this study was above 0.77, which is higher than the recommended cutoff of 0.70 (Fornell and Larcker, 1981). Table II shows that the composite reliabilities and Cronbach's alpha for the measures are above the threshold of 0.7, and the AVE of our scales range from 0.67 to 0.94, which is above the recommended value of 0.5 (Fornell and Larcker, 1981).The discriminant validity of the scales is assessed by comparing the square root of the AVE with the correlations among the five constructs (Fornell and Larcker, 1981). The square root of the AVE for each construct should exceed the correlation between any pair of distinct constructs (Chin, 1998). The results in Table III show adequate validity.

*Model testing*

Respondents were classified into three groups according to frequency of mobile internet use: non-users, infrequent users and frequent users. Figures 2-4 present graphical depictions of the PLS results for the three groups, showing the standardized path coefficients among the constructs and the explained variance ($R^2$). A bootstrapping approach, where 100 random samples of observation were generated from the original dataset, was used to test the hypotheses.

For the non-user group (Figure 2), only perceived content ($\beta = 0.36$, $t = 4.37$) and perceived infrastructure ($\beta = 0.23$, $t = 2.48$) significantly influenced user attitudes. Hence, *H2* and *H3* were supported but *H1* and *H4* were not. The results also showed that intention to use mobile internet services was predominantly determined by attitude ($\beta = 0.52$, $t = 5.49$) while intention to pay for mobile internet services was positively affected by intention to adopt Android smartphones ($\beta = 0.13$, $t = 1.80$), supporting *H5* and *H6*. Among the constructs of perceived value, for non-users this study only measured the constructs of perceived performance/quality value and price/value for money because non-users would have difficulty evaluating the emotional value and social value of such services. The results showed that perceived

| Construct | Item | Loading | Composite reliability | AVE | Cronbach's α |
|---|---|---|---|---|---|
| Interface convenience (IC) | 1 | 0.88 | 0.91 | 0.77 | 0.85 |
| | 2 | 0.90 | | | |
| | 3 | 0.86 | | | |
| Perceived content (PC) | 1 | 0.83 | 0.86 | 0.67 | 0.76 |
| | 2 | 0.86 | | | |
| | 3 | 0.77 | | | |
| Perceived infrastructure (PI) | 1 | 0.86 | 0.89 | 0.72 | 0.81 |
| | 2 | 0.91 | | | |
| | 3 | 0.78 | | | |
| Design aesthetics (DA) | 1 | 0.89 | 0.92 | 0.78 | 0.86 |
| | 2 | 0.90 | | | |
| | 3 | 0.87 | | | |
| Attitude (ATT) | 1 | 0.90 | 0.92 | 0.79 | 0.87 |
| | 2 | 0.88 | | | |
| | 3 | 0.89 | | | |
| Intention to adopt Android smartphones (IND) | 1 | 0.97 | 0.97 | 0.94 | 0.93 |
| | 2 | 0.97 | | | |
| Intention to pay for mobile internet services (INP) | 1 | 0.97 | 0.97 | 0.94 | 0.93 |
| | 2 | 0.97 | | | |
| Emotional value (EV) | 1 | 0.87 | 0.94 | 0.74 | 0.91 |
| | 2 | 0.84 | | | |
| | 3 | 0.84 | | | |
| | 4 | 0.88 | | | |
| | 5 | 0.88 | | | |
| Price/value for money (PVM) | 1 | 0.95 | 0.97 | 0.91 | 0.95 |
| | 2 | 0.96 | | | |
| | 3 | 0.96 | | | |
| Performance/quality value (PQV) | 1 | 0.93 | 0.95 | 0.87 | 0.92 |
| | 2 | 0.92 | | | |
| | 3 | 0.94 | | | |
| Social value (SV) | 1 | 0.92 | 0.96 | 0.86 | 0.95 |
| | 2 | 0.94 | | | |
| | 3 | 0.94 | | | |
| | 4 | 0.91 | | | |

**Table II.**
Individual item reliability

performance/quality value ($\beta = 0.20$, $t = 1.97$) and price/value for money ($\beta = 0.39$, $t = 3.87$) positively influenced intention to pay for mobile internet services. Thus, *H9* and *H10* were supported.

As shown in Figure 3, among infrequent users only perceived content ($\beta = 0.34$, $t = 3.09$) and perceived infrastructure ($\beta = 0.26$, $t = 1.95$) significantly influenced user attitudes, supporting *H2* and *H3*, but not *H1* and *H4*. The results also demonstrated that intention to use mobile internet services was directly influenced by attitude ($\beta = 0.55$, $t = 5.17$). Unexpectedly, intention to pay for mobile internet

| | Construct | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | IC | PC | PI | DA | ATT | IND | INP | EV | PVM | PQV | SV |
| IC | 0.88 | | | | | | | | | | |
| PC | 0.66 | 0.82 | | | | | | | | | |
| PI | 0.50 | 0.55 | 0.89 | | | | | | | | |
| DA | 0.57 | 0.61 | 0.57 | 0.85 | | | | | | | |
| ATT | 0.55 | 0.63 | 0.50 | 0.56 | 0.89 | | | | | | |
| IND | 0.48 | 0.51 | 0.39 | 0.44 | 0.55 | 0.97 | | | | | |
| INP | 0.27 | 0.30 | 0.23 | 0.30 | 0.27 | 0.30 | 0.97 | | | | |
| EV | 0.39 | 0.38 | 0.35 | 0.38 | 0.33 | 0.40 | 0.54 | 0.86 | | | |
| PVM | 0.18 | 0.20 | 0.22 | 0.24 | 0.18 | 0.09 | 0.49 | 0.41 | 0.96 | | |
| PQV | 0.25 | 0.25 | 0.27 | 0.32 | 0.18 | 0.13 | 0.42 | 0.55 | 0.64 | 0.93 | |
| SV | 0.25 | 0.26 | 0.27 | 0.26 | 0.28 | 0.17 | 0.31 | 0.43 | 0.38 | 0.38 | 0.93 |

**Notes:** The diagonal elements show the square root of the average variance extracted; The off diagonal elements show the correlations between constructs

**Table III.**
Analysis of discriminant validity



services was not significantly affected by intention to adopt Android smartphones. Therefore, *H5* was supported but *H6* was not. Among the constructs of perceived value, emotional value ($\beta = 0.37$, $t = 2.80$) and price/value for money ($\beta = 0.27$, $t = 2.28$) significantly influenced intention to pay for mobile internet services while the impacts of performance/quality value and social value were not significant. Hence, *H7* and *H9* were supported but *H8* and *H10* were not.

As seen in Figure 4, for frequent users interface convenience ($\beta = 0.21$, $t = 1.78$) and perceived content ($\beta = 0.33$, $t = 2.30$) directly affected user attitude while the effects of perceived infrastructure and design aesthetics on the attitude were not significant. Hence, *H1* and *H2* were supported but *H3* and *H4* were not. In addition, the results demonstrated that attitude had a strong influence on intention to use mobile internet services ($\beta = 0.55$, $t = 6.80$) while intention to pay for mobile internet services was positively influenced by intention to adopt Android smartphones ($\beta = 0.19$, $t = 2.10$), thus supporting *H5* and *H6*. Among the constructs of perceived value, emotional value ($\beta = 0.21$, $t = 1.76$) and price/value for money ($\beta = 0.42$, $t = 3.90$) also had stronger effects on intention to pay for mobile internet services while the influence of performance/quality value and social value were not significant. Hence, *H7* and *H9* were supported but *H8* and *H10* were not. Table IV summarizes all testing results.

Since e-book reading behavior is an important issue in smartphone context, a Pearson correlation test was conducted to explore the relationships between the behavior and other individual factors. The results are summarized in Table V. Only income and gender were found to be significantly correlated with the frequency of e-book reading.

## 5. Discussion

The present research developed a model to investigate the key elements of user attitudes toward Android smartphones and how a positive attitude might influences user intention to adopt Android smartphones and pay for mobile internet services. In addition, the effects of the values of mobile internet services on intention were also verified. The influence of the factors in different user groups is discussed below.

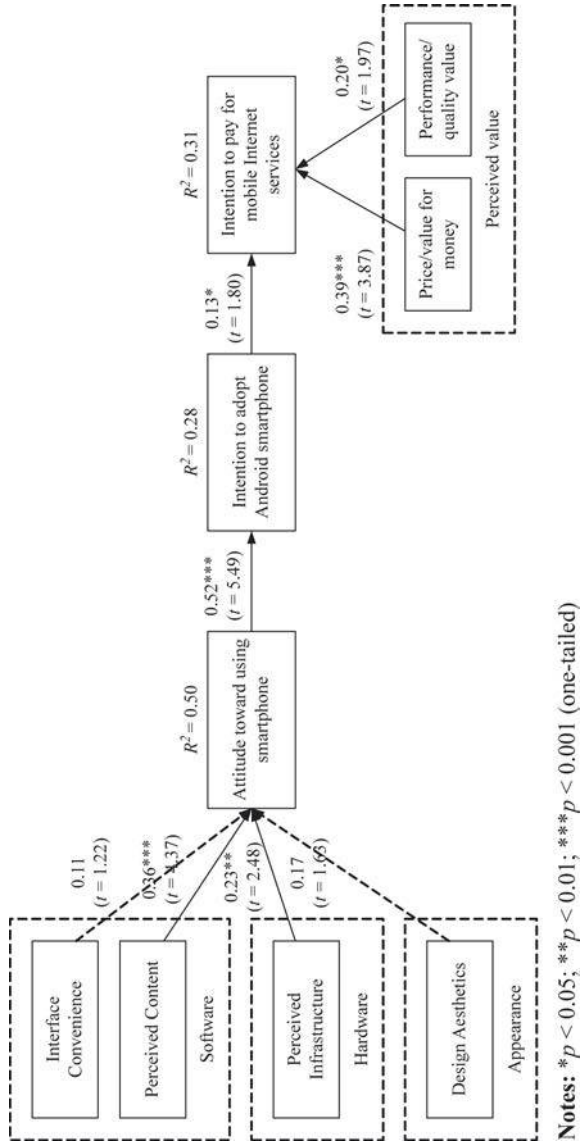


**Figure 2.**
Analysis results of never-use group

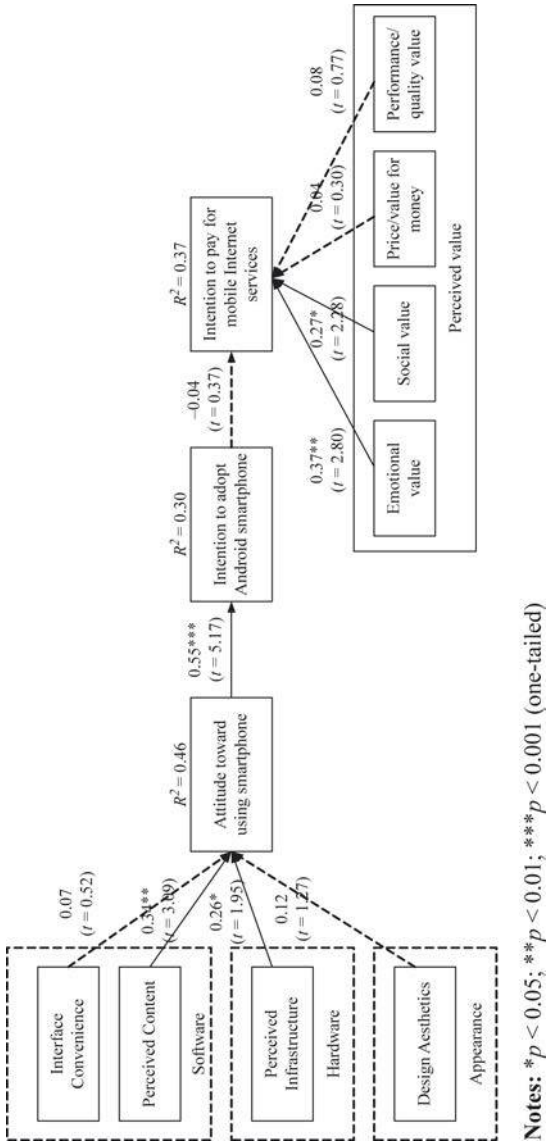


**Figure 3.**
Analysis results of seldom-use group

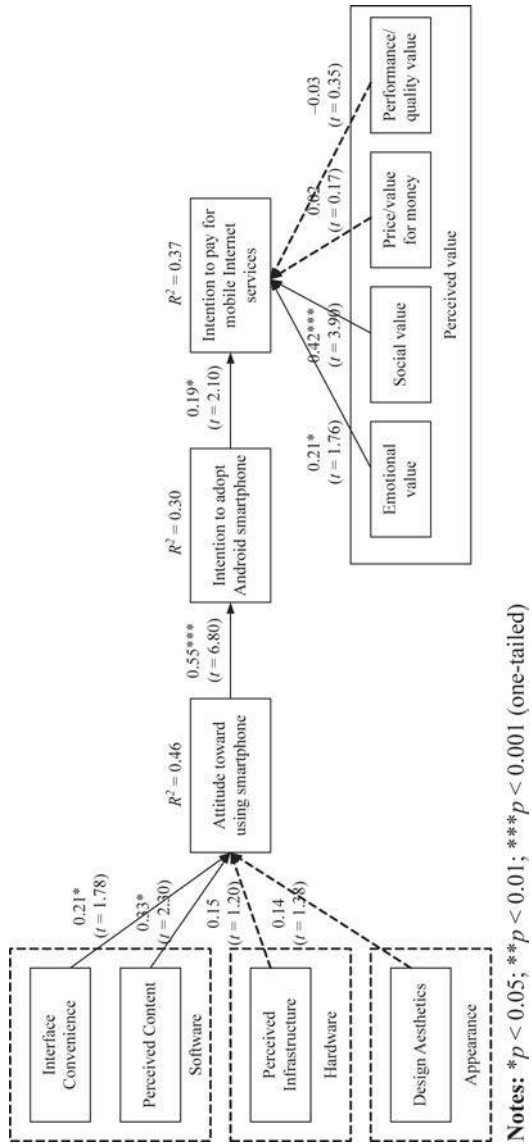


**Figure 4.**
Analysis results of often-use group

| Hypothesis | Path | Never-use | Seldom-use | Often-use | Conclusion |
|---|---|---|---|---|---|
| *H1* | IC → ATT | ns | ns | 0.21* | Partially supported |
| *H2* | PC → ATT | 0.36*** | 0.34*** | 0.33** | Supported |
| *H3* | PI → ATT | 0.23** | 0.26** | ns | Partially supported |
| *H4* | DA → ATT | ns | ns | ns | Not Supported |
| *H5* | ATT → IND | 0.52*** | 0.55*** | 0.55*** | Supported |
| *H6* | IND → INP | 0.13* | ns | 0.19* | Partially supported |
| *H7* | EMV → INP | ne | 0.37** | 0.21* | Supported |
| *H8* | SV → INP | ne | 0.27* | 0.42*** | Supported |
| *H9* | ECV → INP | 0.39*** | ns | ns | Partially supported |
| *H10* | QV → INP | 0.20* | ns | ns | Partially supported |

**Note:** ns: not significant; ne: not evaluated

**Table IV.**
Results of testing

| | | Gender | Age | Education level | Income |
|---|---|---|---|---|---|
| Reading e-books through smartphone | Pearson | −0.079* | 0.030 | −0.050 | 0.124** |
| | Sig. | 0.019 | 0.377 | 0.142 | 0.000 |

**Notes:** * $p < 0.05$; ** $p < 0.001$ (two-tailed); Male = 1; Female = 2

**Table V.**
Results of correlation test



*Attitude and intention*

Among all three user groups, attitudes toward android devices was found to have a strong impact on intention to adopt Android smartphones, suggesting that positive attitude is the key factor in determining intention. However, intention to adopt Android smartphones did not have significant effect on intention to pay in the infrequent-use group. This may possibly be due to factors related to usage habits or preferences, or to the availability of free wireless internet (such as Wi-Fi) at home, schools or work. Although self-identified non-users have never used mobile internet services, their intention to adopt Android smartphones significantly affected their intention to pay to pay for such services, suggesting that they may have the need for such services and could be considered potential customers.

*Antecedents of attitude*

Interface convenience was found to have a significant impact on user attitude only among frequent users, who often use their Android devices to browse web pages and search for information online, and thus would value operational efficiency and interface convenience. Perceived content had the most significant effect on attitude in all groups, indicating that a smartphone's functions or software are the key consideration. In addition, perceived infrastructure directly influenced attitudes among non-users and infrequent users, suggesting that these groups are most concerned with efficiency. Therefore, manufacturers of smartphone should strive to continuously improve hardware design and performance. Surprisingly, design aesthetics had no significant effect in any groups, possibly because most Android smartphones are similar in appearance: most models are black or white slabs, offering users little choice.

*Perceived value of mobile internet services*

Among non-users, price/value for money and performance/quality value were found to be the factors influencing intention to pay for mobile internet services. However, among infrequent and frequent users, these factors were not significant, while social value and emotional value had significant impact. These results indicate that, in decisions regarding the use of mobile internet services, mobile internet users give more consideration social value and emotional value, along with price/value for money and performance/quality value. Therefore, mobile internet services which enhance users' positive feelings (e.g. pleasure and social status) will attract more paid subscribers.

*Individual differences*

Male users were found to be more likely to read e-books on their smartphones, as are people with higher personal incomes, and should be the focus of marketing for e-book service providers.

## Practical implications

*Software*

Usability and user interface design are key issues for the design of smartphone software (Choi and Lee, 2012). Interface convenience can simplify device operation and provide more effective human-system interaction. Interface convenience was found to have a more significant impact for frequent users given their increased rate of interaction with the device. Therefore, to encourage increased smartphone and mobile internet usage, providers must continuously improved interface designs and features. In addition, smartphone function (content) was found to be the main factor which can increase positive attitudes toward smartphones, and improved quality or usability will motivate behavioral intention, such as the adoption of mobile learning or online payment intention (Shin *et al.*, 2011).

*Hardware and appearance*

Today, an increasing number of people use smartphones to execute routine tasks, thus making hardware efficiency a crucial factor in user productivity (Kalkbrenner and McCampbell, 2011). For example, handwriting text entry systems can help elder users keep a calendar more efficiently. Hardware (infrastructure) was found to have less impact on the usage intention of professional users (frequent-users) than among infrequent and non-users. Hence, to increase smartphone adoption, manufacturers should upgrade and enhance their hardware infrastructure, such as faster processors, better antennas, more pervasive 3G networks. Furthermore, although design aesthetics has little impact on user attitudes, it is believed that the demand for customized products is still existed. Smartphone manufacturers and telecommunication companies can increase revenues by providing customized services for customers with special demands, such as laser engraving on smartphone shells.

## Conclusions, limitations and future research

This study explores factors which increase user intention to use mobile internet services through Android devices. The proposed model improves understanding of the influence of the Android devices ownership on user intention to adopt and pay for mobile internet services. Our research found that interface convenience, perceived

content, and perceived infrastructure are factors which influence user intention indirectly through attitude, with perceived content having the strongest impact. From a practical standpoint, the insights raised can provide guidance for the design of android devices.

In addition, the impact over various values differs according to frequency of mobile internet use. The results can assist telecommunication companies in understanding the needs of different types of users. Furthermore, male users and those with higher personal incomes were found to be attractive targets for publishers seeking to increase readership of e-books on Android smartphones.

This study suffers from several limitations. First, it focuses exclusively on the effect of attitude on the intention to use and pay for mobile internet services. Other relational constructs, such as subjective norms, critical mass, or network externality, could affect the intentions and should also be comprehensively examined in further research (Lin and Lu, 2011). Second, the questionnaire survey was conducted online using a self-reporting scale to measure research variables, and thus may be subject to method bias. Third, our research participants were self-selecting members of an online community and may not be representative of all consumers. The results and implications are limited to the case studied. Thus further research is needed to generalize our findings. Finally, this study was cross-sectional, so we cannot measure user reactions over time. Our model requires additional research to evaluate its validity, and longitudinal evidence would help predict behavior over time, thus enhancing our understanding of the causality and interrelationships between variables.



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## Further reading

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## Appendix. Research constructs and scale items

*Perceived content*

- The feature of my Smartphone is useful.
- The feature of my Smartphone is complete.
- The feature of my Smartphone is clear.

*Perceived infrastructure*

- I find it is fast when using my Smartphone.
- It is efficient to use my Smartphone.
- It looks easy to use my Smartphone.

*Interface convenience*

- When I use my Smartphone, I can easily recognize where the needy information is located.
- When I use my Smartphone, I can easily recognize where I navigate.
- I think that the screen design of my Smartphone is harmonious.

*Design aesthetics*

- The screen design (i.e. colors, icons, menus, etc.) is attractive.
- The Smartphone looks professionally designed.
- The overall look and feel of the Smartphone is visually appealing.

*Intention to adopt Android smartphones*

- I intend to use continuously my Android smartphone.
- I predict that I would use continuously my Android smartphone in future.

*Positive attitude*

- I like using this Smartphone.
- It is beneficial to use this Smartphone.
- It is wise to use this Smartphone.

*Intention to pay for mobile internet service*

- I intend to pay for using mobile internet services in future.
- I predict that I would pay for using mobile internet services in future.

*Emotional value*

- Mobile internet services are ones that I enjoy.
- Mobile internet services make me want to use them.
- Mobile internet services are ones that I feel relaxed about using.
- The use of Mobile internet services makes me feel good.
- The use of Mobile internet services gives me pleasure.

*Social value*

- The use of mobile internet service helps me feel acceptable.
- The use of mobile internet service improves the way I am perceived.
- The fact I use mobile internet service makes a good impression on other people.
- The use of mobile internet services gives me social approval.

*Price/value for money*

- Mobile internet services are reasonably priced.
- Mobile internet services offer value for money.
- Mobile internet services are good relative to the price.
- Mobile internet services are economical.

*Performance/quality value*

- Mobile internet services have an acceptable standard of quality.
- Mobile internet services have consistent quality.
- Mobile internet services are well designed.

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