Industrial Management & Data Systems

What catalyses mobile apps usage intention: an empirical analysis

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Received 27 January 2015
Revised 19 April 2015
17 May 2015
Accepted 18 May 2015

Abstract

Purpose – Considering the lack of understanding of the mobile applications (mobile apps) market and low usage rates among Malaysians, Unified Theory of Acceptance and Use of Technology 2 (UTAUT2) was adapted to investigate the determinants of consumer behavioural intention (BI) to use mobile apps.
Design/methodology/approach – A total of 288 sample data was collected and analysed using partial least square equation modelling (PLS-SEM) method.
Findings – All of UTAUT2 constructs (i.e. performance expectancy, effort expectancy, facilitating conditions, hedonic motivation, and habit), except for price value and social influence, significantly relate with BI to use mobile applications. Habit was reported to have the strongest influence. Gender and educational level were found to be insignificant moderators.
Practical implications – Mobile application developers could have better understanding on users' needs and intention, based on the findings.
Originality/value – In order to shed light on current problems, and there is a dearth in relevant studies which could resolve the issue, this paper contributes the necessary knowledge on mobile apps acceptance to developers. Educational level was added into UTAUT2 as a moderator in addition to gender.

Keywords Consumer behavioural intention, Gender, Educational level, Malaysia, Mobile applications, UTAUT2
Paper type Research paper

1. Introduction

In recent years, mobile devices (m-devices) have become a necessary gadget in the modern lifestyle, as the number of m-devices is expected to exceed the world population (Mclaughlin, 2013). M-devices, such as smartphones and tablets, not only provide users with entertainment but also productivity through mobile apps (Keith *et al.*, 2013). Islam *et al.* (2010) defined mobile apps as software that could perform certain tasks for the users using their m-devices. Examples of apps include tools and productivity (calendar, notes, flashlight, alarms), shopping (Amazon), games, and music (games, radio, music player) (Bomhold, 2013). Gartner Incorporate predicted that the annual downloads would reach 268 billion by 2017 (Gartner, 2013).

The chief officer of Industry Regulation of Malaysian Communications and Multimedia Commission (MCMC) emphasized that the app development industry in Malaysia was still underdeveloped due to the lack of understanding of the market (The Star, 2013). This possibly drives the low acceptance rate of locally developed apps

Industrial Management & Data Systems
Vol. 115 No. 7, 2015
pp. 1269-1291

0263-5577
DOI 10.1108/IMDS-01-2015-0028

in Malaysia (Eu, 2011). Furthermore, it is difficult for developers to develop a mobile app, owing to the different hardware specifications such as the memory size, screen size, and processing capacity (Rodriguez-Sanchez *et al.*, 2013).

As noted by Varshney and Vetter (2002), there are several classes of mobile commerce (m-commerce) applications, such as mobile entertainment and mobile advertising. Mobile apps are therefore another class of m-commerce applications. Considerable researches on m-commerce applications have been carried out as well, for instance, mobile advertising (Parreño *et al.*, 2013), mobile payment (Teo *et al.*, 2015), and mobile TV (Wong *et al.*, 2014). There are some studies pertaining to mobile apps, such as Bomhold (2013), which only measured mobile apps usages among undergraduate students. Kang (2014) also combined Unified Theory of Acceptance and Use of Technology (UTAUT); and uses and gratifications theory to understand mobile apps usage intention. However, UTAUT was developed for organizational contexts (Venkatesh *et al.*, 2012). Therefore, the study that utilizes UTAUT2 to investigate mobile apps usage intention currently remains limited.

Considering the current problems, this research intends to discover the motivators behind mobile apps usage intention by utilizing the constructs in UTAUT2. UTAUT2 is preferred due to its higher predictive power (Venkatesh *et al.*, 2003, 2012) and was designed based on the consumers' context (Venkatesh *et al.*, 2012). This study is expected to benefit mobiles apps developers, and at the same time enriching the existing literature.

The outline of this study is as follows. Literature review is presented next, followed by the hypotheses development. Subsequently, before presenting the research findings, the methodology and data analysis of this study are described. Lastly, limitations, implications, together with future recommendation of this study are laid down accordingly.

2. Literature review

2.1 Overview of mobile apps

There are three types of mobile apps, namely, native apps, web apps, and hybrid apps. Native apps are developed for one operating system (i.e. iOS). Web apps are websites that look similar to the native apps. Users first access to this kind of apps by entering a specific URL address into the browser, in which then the users would be given the choice of whether to install the app onto the device. After the installation, a "bookmark" for that URL would be created. Hybrid apps, on the other hand, blend the characteristics of both native and web apps. Web apps are "wrapped" by the layer of native apps. Basically, the way of how hybrid apps function is similar to web apps. Angry Birds, Financial Times, and Banana Republic are examples for native apps, web apps, and hybrid apps, respectively (Budiu, 2013; Lionbridge, 2012; Skidmore, 2013).

Therefore, in this study, mobile apps have been defined as software or a set of programme that could be executed to perform certain tasks for users on m-devices (Islam *et al.*, 2010).

2.2 Evolution of IT acceptance model and theory

There are two important streams that focus on technology acceptance, adoption, and usage. The first stream determines users' adoption and usage of technology from the diffusion of technology (DOI) perspective, while the other stream uses intention-based models and mainly includes Theory of Planned Behaviour (TPB). Theory of reasoned action (TRA), and technology acceptance model (TAM) (Taylor and Todd, 1995).

DOI (Rogers, 1995) proposes five attributes of innovation that may influence the acceptance behaviour, which are compatibility, complexity, observability, relative

advantage, and trialability (Yahya *et al.*, 2011). However, Crabbe *et al.* (2009) pointed out that, DOI is more suitable for investigating diffusion across a nation, rather than individual adoption decisions.

TRA (Ajzen and Fishbein, 1980) stated that one's behaviour is directly influenced by his or her BI to implement the behaviour, and the contributing factors of BI are attitude and subjective norms. Ajzen (1991) proposed TPB by adding perceived behavioural control into TRA.

TAM (Davis *et al.*, 1989; Davis, 1989) was adapted from TRA and suggested that one's actual system usage was influenced by BI. The BI is affected by both perceived usefulness (PU) and attitude towards using. Attitude is ascertained by perceived ease of use (PEOU) and PU. External variables (e.g. training and computer self-efficacy) affect both of the beliefs and therefore having indirect effect on actual system usage at the end. Moreover, PEOU also exerts influence on PU (Davis and Venkatesh, 1996).

UTAUT was proposed by Venkatesh *et al.* (2003) and aimed to combine eight well-known IT acceptance and usage models. There are four core determinants of BI and usage behaviour (UB) towards technology, namely, effort expectancy (EE), facilitating conditions (FC), performance expectancy (PE), and lastly social influence (SI). Venkatesh *et al.* (2003) claimed that UTAUT captures the essences of those established models and it is able to explain 70 per cent of the variance (adjusted R^2) in BI.

Venkatesh *et al.* (2012) extended UTAUT to UTAUT2 by adding habit (HA), hedonic motivation (HM), and price value (PV). Venkatesh *et al.* (2012) asserted that UTAUT2 is better than UTAUT, as the percentage of variance explained in both BI and technology use are higher in UTAUT2.

UTAUT2 could yield high variance explained in BI, and hence the main reason why UTAUT2 was adopted. Maurits (2012) stated that the higher the variance explained in a model, the better the model was. As mentioned earlier, the study that utilizes UTAUT2 and focuses on mobile apps is still lacking. Therefore, it is worth to explore the applicability of UTAUT2 in the area of mobile apps.

3. Hypotheses formation

3.1 PE

PE was defined as "the degree to which using a technology will provide benefits to consumers in performing certain activities" (Venkatesh *et al.*, 2012, p. 159). Pynoo *et al.* (2011) highlighted that PE is the mixture of PU from TAM and other constructs related to usefulness of a technology in other models. Moreover, the acceptability of a system increases if consumers found that it is easy to use and learn (Pikkarainen *et al.*, 2004). PE has been proven to have significant positive relationship with BI to adopt m-commerce by Chong (2013) based on the studies done by Venkatesh *et al.* (2012) and Luo *et al.* (2010) in the area of mobile internet and mobile banking services, respectively. Mobile apps are able to provide useful functions to m-device users, for instance, navigation apps that can lead users to the destination. Thus, if a user finds that mobile apps are useful, then he or she would have higher intention to use mobile apps. Therefore, this study hypothesizes that:

H1. PE has positive influence on BI to use mobile apps.

3.2 EE

EE is described as "the degree of ease associated with consumers' use of technology" (Venkatesh *et al.*, 2012, p. 159). Pynoo *et al.* (2011) pointed out that EE contains constructs which are similar with PEOU from TAM. Chong (2013) and Venkatesh *et al.* (2012)

found that EE is one of the significant determinants of BI. PE and EE are also commonly known as PU and PEOU, respectively (Pynoo *et al.*, 2011), and studies (e.g. Leong *et al.*, 2013a) have shown that the PEOU exerts positive significant influence over PU. Moreover, another study that utilized UTAUT constructs has also confirmed the positive and significant influence of EE over PE (Zhou *et al.*, 2010). Mobile apps are easy to operate (Islam *et al.*, 2010), mainly due to the widespread of touchscreen m-devices nowadays (Chang *et al.*, 2012). Users could feel more direct control over touchscreen devices, due to the direct nature of touch (Brasel and Gips, 2014). Leong *et al.* (2013a) also agreed that adoption rate of a technology is higher if the technology is easy to use. Thus, it is hypothesized that if a user perceives that mobile apps are easy to use, he or she would have higher intention to use them and consequently have positive perception on the usefulness of the mobile apps:

H2a. EE has positive influence on BI to use mobile apps.

H2b. EE has positive influence on PE.

3.3 PV

PV has been defined as "consumers' cognitive trade-offs between the perceived benefits of the applications and the monetary cost for using them" (Venkatesh *et al.*, 2012, p. 161). Hanafizadeh *et al.* (2014) revealed that cost of using mobile banking services is one of the adoption determinants that customers would consider. Additionally, Venkatesh *et al.* (2012) concluded that a positive PV could affect BI positively. PV actually follows the idea of perceived value (Venkatesh *et al.*, 2012), which is also evaluating and comparing the perceptions of relative rewards received and the associated sacrifices paid (Zenithal, 1988). The significant influence of perceived value over intention has been proved in some studies (Deng *et al.*, 2014). If perceived benefits outweigh the monetary sacrifices paid for IT applications, this could influence the technology usage (Venkatesh *et al.*, 2012). Thus, if a consumer perceives that the benefits and advantages received from the usage of the app outweigh the price paid, he or she would have the intention to buy and use it; hence, the next hypothesis pertaining to the PV is formed:

H3. PV has positive influence on BI to use mobile apps.

3.4 FC

FC is "consumers' perceptions of the resources and support available to perform a behaviour" (Venkatesh *et al.*, 2012, p. 159). Lewis *et al.* (2013) argued that individuals usually look for assistance when they are experiencing the use of new technology. They further opined that individuals might restrain from adopting when FC is insufficient. FC is significantly affecting the BI to adopt m-commerce in the study carried by Chong (2013). It has been found that the easiness for consumers to get helps from others when they faced problems in using m-commerce is one kind of FCs that affects m-commerce adoption in China. The result is consistent with the study from Venkatesh *et al.* (2012) that one of the FCs that promotes mobile internet adoption is the mobile phones. Moreover, in the study of mobile banking, Crabbe *et al.* (2009) agreed with the above results. FC is related to mobile apps including online helps and supports, m-devices, internet connection, and so forth. The high level of users' perception on FC available to them leads to a high level of BI; and thus, the following hypothesis is formed:

H4. FC has positive influence on BI to use mobile apps.

3.5 HA

HA is defined as "the extent to which people tend to perform behaviours automatically because of learning", and it can also be viewed as a "perceptual construct that reflects the results of prior experiences" (Venkatesh *et al.*, 2012, p. 161). Moreover, past experience in using identical technologies is able to influence the adoption of a new technology (Crabbe *et al.*, 2009). From the study done by Chuang (2011) in Taiwan, HA is one of the important predictors of intention to switch mobile telecommunications service providers. Furthermore, Nikou and Bouwman (2014) have also consented on the influential power of HA over BI to use mobile social networking sites. We are reliant on computer software massively in our daily lives. It is posited that this prior experience forms the HA towards mobile apps; and hence, this HA influence BI to use mobile apps accordingly:

H5. HA has positive influence on BI to use mobile apps.

3.6 Social influence (SI)

SI was defined by Venkatesh *et al.* (2012, p. 159) as the "the extent to which consumers perceive that important others (e.g. family and friends) believe they should use a particular technology". Wei *et al.* (2009) stated that SI has two categories: mass media influence and interpersonal influence. Newspapers, academic journals, magazines, internet, radio, television, and other applicable mediums are under the category of mass media influence; while interpersonal influence normally results from social networks such as peers, friends, superiors, and so forth. Moreover, Venkatesh *et al.* (2003) observed that SI is only significant under mandatory settings. Chong (2013) found that SI is a significant determinant of BI in the study of m-commerce. Consumers of m-commerce are likely to be influenced by their peers, family, media, and other users of m-commerce in forming their BI. Chong *et al.* (2012) noticed that SI significantly affects the intention of both Malaysian and Chinese consumers to adopt m-commerce. Moreover, Leong *et al.* (2013b) supported the above conclusion. Since mobile apps are not only usable by certain groups of user and its use is mandatory (based on one's will), there is a chance that users of mobile apps are forming the BI based on the SI. Hence, the following hypothesis is formed accordingly:

H6. SI has positive influence on BI to use mobile apps.

3.7 HM

HM means "the fun or pleasure derived from using a technology" (Venkatesh *et al.*, 2012, p. 161). This construct is conceptualized as perceived enjoyment in other technology acceptance theories or models (Venkatesh *et al.*, 2012). If a technology is pleasurable and fun to use, users are able to attain enjoyment in using it (Lee, 2009). In the mobile entertainment study done by Leong *et al.* (2013b), consumers are willing to use mobile entertainment if the usage of it is able to bring joy and happiness. Besides, HM has been proven as a significant factor of BI to adopt mobile internet under the consumer context (Venkatesh *et al.*, 2012). Various categories of mobile apps such as games are able to bring fun and entertainment to users. If an individual conceives that the usage of mobile apps is enjoyable, he or she would have higher intention to use mobile apps. Therefore this study forms the following hypothesis:

H7. HM has positive influence on BI to use mobile apps.

3.8 Moderating variables

Men and women tend to have different perspectives in technology usage decisions (Venkatesh and Morris, 2000). Yang (2005) further asserted that gender moderates

consumer's ICT adoption decision. In m-commerce applications' contexts, Yuan *et al.* (2014) discovered that men are easier to cease using m-banking services as compared to women once they consider it risky to perform transactions online. Yang (2005) also agreed that men generally express favourable view towards m-commerce. Hence, gender was found to moderate the effects of PE, EE, SI, FC, PV, HM, and HA on BI (Venkatesh *et al.*, 2003, 2012). The moderating role of educational level (EL) has been neglected by past studies (Li *et al.*, 2014), and neither UTAUT (Abu-Shanab, 2011) nor UTAUT2 has included EL as a moderator. The moderating effects exerted by EL on PE, EE, and SI have been proven by Park *et al.* (2007) in the study of mobile technologies adoption. There are other technology adoption studies which support EL being the moderator between PE and BI (Abu-Shanab, 2011). Based upon these evidences, the following hypothesis is formed:

H8. Gender and EL moderate all relationships among constructs in the research model.

3.9 Research model

The relationships between the constructs are shown in the following research model (Figure 1). All the seven determinants act as independent variables, while gender and EL serve as moderating variables. In view that the age group of the target respondents is too narrow, age was then dropped. This approach is similar to Wong *et al.* (2014). Experience was operationalized by Venkatesh *et al.* (2012, p. 162) as "the passage of time from the initial use of a target technology". Since this is a cross-sectional study, experience was unable to be measured. Besides, considering that BI is the major determinant of actual UB (Kuo and Yen, 2009), BI is "assumed here to be a definite indicator of actual consumer behaviour" (Chen, 2013, p. 430) and functions as "a proxy for measuring actual behaviour" (Vlachos and Vrechopoulos, 2008, p. 288). Hence, for model simplicity purpose, use behaviour was removed.

4. Methodology

4.1 Sampling procedure and data collection

The target population for this study is mobile apps users, based on the reason that they could provide better insights on what drives them to use mobile apps. The survey questionnaire was reviewed and pre-tested by five dominant researchers in the m-commerce field. Minor adjustment was done to ensure the items were easy to understand. Self-administrated questionnaire was distributed to students in a large private university in Malaysia. According to Compeau *et al.* (2012), students have also been used in IS research for more than 20 years. Compeau *et al.* (2012) further highlighted that for studies using students as sample, if students are part of the target population, then generalizable statement about the research findings could be formed. Bowen and Pistilli (2012) discovered that university students heavily rely on mobile apps to achieve daily tasks, as compared to using the internet. Moreover, as cited by Leong *et al.* (2013a), university students are more open to adopt new ICTs at this age bracket (Yang, 2005). Considering that university students are part of the target population, and they are inseparable from mobile apps and ICTs, it is reasonable and justifiable to select students as the target respondents. On the other hand, those students come from different religions, races, cultural backgrounds, and states of Malaysia, thus it is reasonable to assume that this group of sample could represent the target population. Since sampling frame is not available, non-probability convenience sampling method was adopted. A total of 288 questionnaires were found to be useful with complete answers.

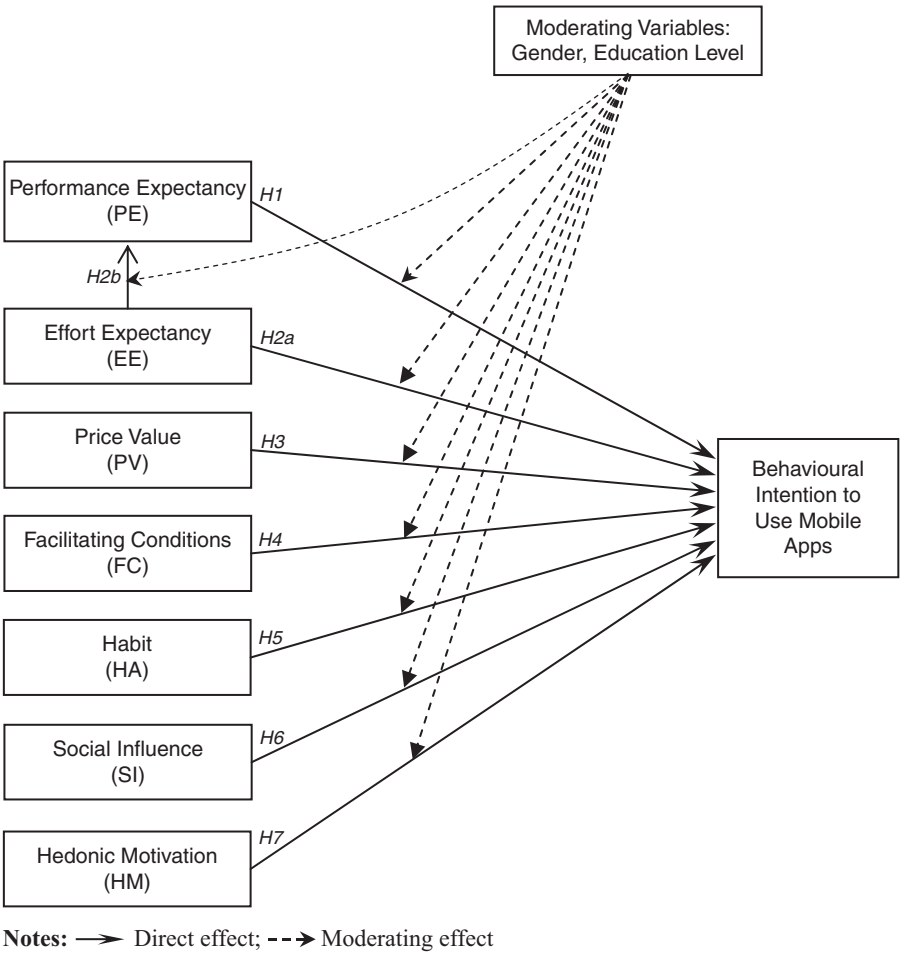

Figure 1.
Research model

As suggested by Armstrong and Overton (1977), we have compared the early and late respondents over several parameters with the rationale that non-respondents tend to closely resemble the later respondents. Therefore, the non-response bias was computed by using the χ^2 test of independence based on responses from the early and late respondents, which showed that there were no significant difference on the categories of apps used (Armstrong and Overton, 1977 as cited in Doong and Wang, 2011).

4.2 Instrument development

The first part of the questionnaire is related to demographic profiles, while the second part consists of 32 items to measure the constructs. All items were adopted from past literatures. Table I shows these items with their respective sources. Costello and Osborne (2005, p. 5) opined that "a factor with fewer than three items is generally weak and unstable", thus a solid factor needs more items. As a result, other than the items provided by Venkatesh *et al.* (2012), more items were adapted, and this approach is consistent with Wong *et al.* (2014). In line with past literatures, all the constructs were

Latent constructs	Indicators	Sources
Performance expectancy (PE) (4 items)	I find mobile apps useful in my daily life (PE1)	Venkatesh *et al.* (2012)
	Using mobile apps helps me accomplish things more quickly (PE2)	
	Using mobile apps increases my productivity (PE3)	
	Using mobile apps enhances my effectiveness on the job (PE4)	Al-Gahtani *et al.* (2007)
Effort expectancy (EE) (5 items)	Learning how to use mobile apps is easy for me (EE1)	Venkatesh *et al.* (2012)
	My interaction with mobile apps is clear and understandable (EE2)	
	I find mobile apps easy to use (EE3)	
	It is easy for me to become skillful at using mobile apps (EE4)	
	Using the mobile apps is simple to me (EE5)	Martin and Herrero (2012)
Price value (PV) (3 items)	Mobile apps are reasonably priced (PV1)	Venkatesh *et al.* (2012)
	Mobile apps are a good value for the money (PV2)	
	At the current price, mobile apps provide a good value (PV3)	
Facilitating conditions (FC) (4 items)	I have the resources necessary to use mobile apps (FC1)	Venkatesh *et al.* (2012)
	I have the knowledge necessary to use mobile apps (FC2)	
	Mobile apps are compatible with other technologies I use (FC3)	
	I can get help from others when I have difficulties using mobile apps (FC4)[a]	
	I feel comfortable using mobile apps (FC5)	Tomas and Elena (2013)
Habit (HA (4 items)	The use of mobile apps has become a habit for me (HA1)	Venkatesh *et al.* (2012)
	I am addicted to using mobile apps (HA2)	
	I must use mobile apps (HA3)	
	Using mobile apps has become natural to me (HA4)	Tomas and Elena (2013)
Social influence (SI) (4 items)	People who are important to me think that I should use mobile apps (SI1)	Venkatesh *et al.* (2012)
	People who influence my behaviour think that I should use mobile apps (SI2)	
	People whose opinions that I value prefer that I use mobile apps (SI3)	
	People around me consider it is appropriate to use mobile apps (SI4)	Martin and Herrero (2012)
Hedonic motivation (HM) (3 items)	Using mobile apps is fun (HM1)	Venkatesh *et al.* (2012)
	Using mobile apps is enjoyable (HM2)	
	Using mobile apps is very entertaining (HM3)	
Behavioural intention (BI) (4 items)	I intend to continue using mobile apps in the future (BI1)	Venkatesh *et al.* (2012)
	I will always try to use mobile apps in my daily life (BI2)	
	I plan to continue to use mobile apps frequently (BI3)	
	I predict I will continue to use mobile apps on a regular basis (BI4)	Al-Gahtani *et al.* (2007)

Table I.
Sources of questionnaire items

Note: [a]Item FC4 was deleted due to the poor loading (< 0.70)

measured by seven-point Likert scale, from 1 "strongly disagree" to 7 "strongly agree". English mediated questionnaire was used, as the target respondents are university students, who should be proficient in English.

4.3 Data analysis

4.3.1 Demographic characteristic of respondents. Table II shows the demographic characteristic of respondents. The percentage of male and female are 39.6 and 60.4 per cent, respectively. Majority of the students are 20-25 years old. Besides, more than half of the respondents reported that they owned a bachelor degree or profession qualification (68.1 per cent). The top three categories of apps used are "Social and communication" (92.4 per cent), followed by "Games and music" (84.4 per cent), and lastly "Search engines" (84.4 per cent). Furthermore, respondents mainly download the mobile apps from Google Play (74 per cent) and App Store (38.9 per cent). In total,

Item	Characteristics	Frequency	%
Gender	Male	114	39.6
	Female	174	60.4
Age	Below 20 years old	7	2.4
	20-25 years old	277	96.2
	26-30 years old	3	1.0
	31-35 years old	1	0.3
Highest education	No college degree	48	16.7
	Diploma/advance diploma	33	11.5
	Bachelor degree/profession qualification	196	68.1
	Master/PhD	11	3.8
Categories of apps used (can select more than one)	Finance, banking, and insurance	81	28.1
	Travel and life	166	57.6
	Hobbies	65	22.6
	Social and communication	266	92.4
	Tools and productivity	202	70.1
	Shopping	73	25.3
	Casual reading	118	41.0
	Entertainment and sports	210	72.9
	Games and music	243	84.4
	Health and fitness	67	23.3
	Reference and libraries	110	38.2
	Search engines	243	84.4
Downloaded from (can select more than one)	App Store (for iOS)	112	38.9
	Google Play (for Android)	213	74.0
	Windows Phone Store (for Windows phone)	9	3.1
	Nokia Store (for Symbian, MeeGo, Maemo)	11	3.8
	BlackBerry World (for BlackBerry OS)	2	0.7
	Others	3	1.0
Download frequency	Daily	16	5.6
	2-4 days once	21	7.3
	5-6 days once	10	3.5
	Weekly	71	24.7
	Monthly	170	59.0

Table II. Demographic characteristic of respondents

59 per cent of the respondents download mobile apps on a monthly basis which strengthens the problem statement of the low usage rate of mobile apps among Malaysians.

4.3.2 Statistical analysis. Using the Smart-PLS 2.0 version, the research model illustrated in Figure 1 is examined using the partial least squares structural equation modelling (PLS-SEM) method (Chan *et al.*, 2010; Ringle *et al.*, 2005). The resampling method with 288 cases and individual sign changes was engaged to obtain inferential statistics (Hair *et al.*, 2011). In accordance to Wu *et al.* (2011), PLS-SEM places minimal demands on the size of the sample as well as the distributions of the residuals. This was also supported by Chin (1998) and Chin *et al.* (2003). Furthermore, to conduct PLS, it requires a sample size that is "10 times of the number of indicators associated with the most complex construct or the largest number of antecedent constructs linking to an endogenous construct" (Wu and Chen, 2014, p. 84). In other words, what seemed to be not large enough for the goodness of model fit for covariance-based SEM, PLS-SEM can overcome such limitation to proceed with the analysis of the measurement model. Hence, PLS is the best statistical tool for small sample sizes. Furthermore, multivariate normal distribution is also not required, hence proving the superiority of such analysis. This was supported by Chin *et al.* (2003) and Lee *et al.* (2015). The measurement model is first tested, followed by the testing of the structural model (Lee *et al.*, 2015; Venkatesh *et al.*, 2012).

4.3.3 Testing for the multicollinearity and common method bias. Variance inflation factor (VIF) and tolerance values were used to assess the multicollinearity problem. The issue pertaining to multicollinearity will arise if the coefficients between the independent variables are too high. As can be seen in Table III, all VIF values are less than ten and tolerance values are greater than 0.10, as suggested by Kline (2005). Furthermore, Table IV also reported the correlation coefficients between variables to be less than 0.90, as suggested by Field (2009). Hence, based on such assumptions, it can be well concluded that multicollinearity problem does not exist. As the data are gathered from single respondents, the common method bias problem was also tested using the Harman's single factor test. Findings reported that the single factor is 39.97 per cent, which is less than 50 per cent. Thus, it is also concluded that the CMB issue does not exist.

	Unstandardized coefficients		Unstandardized coefficients			Collinearity statistics	
	B	SE	*β*	*t*	Sig	Tolerance	VIF
Constant	7.280E-006	0.033		0.000	1.000		
EE	0.175	0.049	0.175	3.588	0.000	0.469	2.134
FC	0.175	0.052	0.175	3.395	0.001	0.421	2.376
HA	0.324	0.047	0.324	6.954	0.000	0.516	1.939
HM	0.270	0.043	0.270	6.310	0.000	0.612	1.635
PE	0.098	0.044	0.098	2.206	0.028	0.568	1.762
PV	0.050	0.037	−0.050	−1.346	0.179	0.821	1.219
SI	0.022	0.045	0.022	0.499	0.618	0.558	1.794

Table III. Testing for multicollinearity

Notes: PE, performance expectancy; EE, effort expectancy; SI, social influence; FC, facilitating conditions; HA, habit; HM, hedonic motivation; PV, price value; BI, behavioural intention. Dependent variable: BI

	BI	EE	FC	HA	HM	PE	PV	SI
BI	*0.8642*							
EE	0.6410	*0.8528*						
FC	0.6668	0.6844	*0.8175*					
HA	0.6960	0.5074	0.5641	*0.9100*				
HM	0.6543	0.4861	0.5084	0.5136	*0.9390*			
PE	0.5832	0.5613	0.5878	0.4897	0.4774	*0.8476*		
PV	0.2706	0.3056	0.3391	0.3081	0.2727	0.2602	*0.8627*	
SI	0.5355	0.4738	0.4969	0.5900	0.4799	0.4231	0.3806	*0.9016*

Notes: PE, performance expectancy; EE, effort expectancy; SI, social influence; FC, facilitating conditions; HA, habit; HM, hedonic motivation; PV, price value; BI, behavioural intention. Diagonal elements (italic) are the square root of the AVE for each construct; Off-diagonal factors demonstrate the inter correlations

Table IV. Discriminant validity test

4.4 Non-response bias

χ^2 test of dependence on the demographic variables was conducted and the results revealed that there is no significant difference between the early and late respondents (Teo *et al.*, 2015; Doong and Wang, 2011; Armstrong and Overton, 1977). The *t*-test was also carried out to test the differences across all the research constructs and the results also revealed that there is no significant difference (Ranganathan *et al.*, 2011; Teo *et al.*, 2015). Hence, the non-response bias issue does not exist in this study.

4.5 Results from statistical analysis

4.5.1 Testing of measurement model. To examine the measurement model, convergent and discriminant tests were carried out. Convergent validity in accordance to Thong (2001, p. 150) is described as "the degree to which two or more items measuring the same variable agree". Convergent validity was assessed for the measurement model based on the following criteria:

(1) factor loadings for all items should exceed 0.70 (Fornell and Larcker, 1981);

(2) composite reliability (CR) for all constructs should exceed 0.60 (Bagozzi and Yi, 1988); and

(3) the average variance extracted (AVE) values should exceed 0.50 (Kline, 1998).

Table V reported that CR for BI = 0.9217; EE = 0.9302; FC = 0.8895; HA = 0.9507; HM = 0.9572; PE = 0.9107; PV = 0.8972 and SI = 0.9456 to be well above 0.60, as recommended by Bagozzi and Yi (1988). The Cronbach's α values for all constructs are reported to be greater than 0.70 (Nunnally and Bernstein, 1994) and the factor loadings for all items were also well above 0.70 in Table V, as recommended by Fornell and Larcker (1981). Lastly, the AVE values for all constructs (i.e. BI = 0.7468; EE = 0.7273; FC = 0.6683; HA = 0.8281; HM = 0.8818; PE = 0.7184; PV = 0.7442 and SI = 0.8129) appears to be greater than 0.50 as recommended by Kline (1998), and thus, convergent validity is achieved.

Discriminant validity, as defined by Thong (2001, p. 152) is "the degree to which items differentiate between variables". It can be assessed by "comparing the level of square root of AVEs and the correlation between the two constructs" (Deng *et al.*, 2014, p. 218). As reported in Table IV, since the square root of AVEs exceeded their

Constructs	Items	Loadings	AVE	Cronbach's α
BI	BI1	0.7942	0.7468	0.8860
(CR = 0.9217)	BI2	0.8897		
	BI3	0.8975		
	BI4	0.8713		
EE	EE1	0.8315	0.7273	0.9059
(CR = 0.9302)	EE2	0.8672		
	EE3	0.8585		
	EE4	0.8133		
	EE5	0.8915		
FC	FC1	0.7945	0.6683	0.8348
(CR = 0.8895)	FC2	0.8690		
	FC3	0.7927		
	FC5	0.8114		
HA	HA1	0.8976	0.8281	0.9309
(CR = 0.9507)	HA2	0.9081		
	HA3	0.9075		
	HA4	0.9266		
HM	HM1	0.9430	0.8818	0.9329
(CR = 0.9572)	HM2	0.9488		
	HM3	0.9252		
PE	PE1	0.8052	0.7184	0.8690
(CR = 0.9107)	PE2	0.8695		
	PE3	0.8688		
	PE4	0.8452		
PV	PV1	0.8651	0.7442	0.8316
(CR = 0.8972)	PV2	0.8582		
	PV3	0.8647		
SI	SI1	0.9117	0.8129	0.9232
(CR = 0.9456)	SI2	0.9265		
	SI3	0.8969		
	SI4	0.8702		

Table V.
Factor loadings, average variance extracted and composite reliability

Notes: PE, performance expectancy; EE, effort expectancy; SI, social influence; FC, facilitating conditions; HA, habit; HM, hedonic motivation; PV, price value; BI, behavioural intention; AVE, average variance extracted; CR, composite reliability

corresponding inter correlations, the discriminant validity has been established (Deng *et al.*, 2014; Leong *et al.*, 2011). Additionally, the loadings and cross-loadings of exploratory factor analysis in Smart PLS show that each item loads highly with its corresponding latent constructs (see Table VI).

4.5.2 Structural model analyses. Figure 2 shows the findings from the hypotheses testing. It reveals that 68.67 per cent of the variation in BI to use mobile apps is explained by the constructs of EE, FC, HM, HA, PE, PV, and SI. Therefore, there is evidence that UTAUT2 is applicable in mobile apps context. Furthermore, the extended UTAUT2 model is also supported by the results in determining consumer intentions towards usage of mobile apps (Yu, 2012). BI to use mobile apps was significantly influenced by HA ($\beta = 0.3239$, $p < 0.01$); HM ($\beta = 0.2698$, $p < 0.01$); EE ($\beta = 0.1753$, $p < 0.01$); FC ($\beta = 0.1751$, $p < 0.01$) and PE ($\beta = 0.0979$, $p < 0.05$). Moreover, HA has been reported to have the strongest influence on BI to use mobile apps. The result also implies that EE was a significant determinant of PE ($R^2 = 31.50$ per cent), since EE

	BI	EE	FC	HA	HM	PE	PV	SI
BI1	*0.7942*	0.5301	0.5813	0.5132	0.5975	0.5341	0.1747	0.3771
BI2	*0.8897*	0.5401	0.5901	0.6253	0.5535	0.5181	0.2418	0.4901
BI3	*0.8975*	0.5624	0.5661	0.6687	0.5501	0.5228	0.2709	0.4954
BI4	*0.8713*	0.5822	0.5671	0.5932	0.5620	0.4402	0.2448	0.4845
EE1	0.5291	*0.8315*	0.5371	0.4059	0.4001	0.4829	0.1564	0.3759
EE2	0.5508	*0.8672*	0.5916	0.4274	0.4289	0.4807	0.2068	0.3901
EE3	0.5489	*0.8585*	0.5702	0.4305	0.4197	0.4633	0.3225	0.4273
EE4	0.5101	*0.8133*	0.5862	0.4332	0.3658	0.4833	0.3270	0.4093
EE5	0.5915	*0.8915*	0.6309	0.4652	0.4551	0.4838	0.2909	0.4180
FC1	0.4956	0.5026	*0.7945*	0.4470	0.3598	0.4547	0.2693	0.4129
FC2	0.5465	0.5870	*0.8690*	0.4513	0.3456	0.4589	0.2638	0.4205
FC3	0.4901	0.5073	*0.7927*	0.3475	0.3233	0.4326	0.2655	0.3465
FC5	0.6268	0.6221	*0.8114*	0.5706	0.5935	0.5580	0.3048	0.4359
HA1	0.6690	0.5027	0.6020	*0.8976*	0.5368	0.5232	0.2501	0.5143
HA2	0.5703	0.4103	0.4553	*0.9081*	0.4260	0.4044	0.2823	0.5060
HA3	0.6155	0.4106	0.4478	*0.9075*	0.4414	0.3871	0.3018	0.5810
HA4	0.6682	0.5117	0.5348	*0.9266*	0.4571	0.4574	0.2894	0.5454
HM1	0.6079	0.4484	0.4916	0.4968	*0.9430*	0.4307	0.2283	0.4606
HM2	0.6150	0.4803	0.4891	0.4637	*0.9488*	0.4677	0.2910	0.4394
HM3	0.6201	0.4406	0.4516	0.4863	*0.9252*	0.4461	0.2487	0.4519
PE1	0.5286	0.4979	0.5158	0.4461	0.4130	*0.8052*	0.1872	0.3223
PE2	0.4887	0.4648	0.4912	0.4269	0.4400	*0.8695*	0.1623	0.3445
PE3	0.4437	0.4533	0.4730	0.3579	0.3840	*0.8688*	0.2607	0.3752
PE4	0.5064	0.4802	0.5061	0.4204	0.3775	*0.8452*	0.2736	0.3923
PV1	0.2765	0.3102	0.3035	0.3219	0.2514	0.2263	*0.8651*	0.3304
PV2	0.1877	0.2394	0.2720	0.2235	0.1944	0.2247	*0.8582*	0.3092
PV3	0.2186	0.2259	0.2968	0.2315	0.2503	0.2223	*0.8647*	0.3426
SI1	0.5151	0.4330	0.4681	0.5704	0.4375	0.4293	0.3541	*0.9117*
SI2	0.4729	0.4473	0.4403	0.5148	0.3825	0.3775	0.3514	*0.9265*
SI3	0.4385	0.4218	0.4380	0.5301	0.4541	0.3576	0.3164	*0.8969*
SI4	0.4973	0.4063	0.4429	0.5093	0.4559	0.3561	0.3470	*0.8702*

Notes: PE, performance expectancy; EE, effort expectancy; SI, social influence; FC, facilitating conditions; HA, habit; HM, hedonic motivation; PV, price value; BI, behavioural intention. Item FC4 was deleted due to poor loading (< 0.70)

Table VI. Loadings and cross-loadings

($\beta = 0.5613$, $p < 0.01$) significantly and positively impacted PE. Hence, *H1*, *H2a*, *H2b*, *H4*, *H5*, and *H7* were supported.

Furthermore, both *H3* and *H6* were not supported, as PV ($\beta = -0.0497$, $p > 0.05$) and SI ($\beta = 0.0223$, $p > 0.05$) did not play a significant role in affecting the BI to use mobile apps.

4.5.3 Moderating effects of gender and EL. PLS-SEM analysis was conducted to investigate the moderating effects of gender and EL on all the paths in the research model (Figure 1). For gender, female was coded as 0, while male coded as 1. EL was separated into two groups, which are lower EL (coded as 1) and higher EL (coded as 2), according to the median of EL. This approach is similar to Park *et al.* (2007). The PLS results with moderators were tabulated in Table VII, which shows that the gender and EL did not moderate all the paths. Therefore, *H8* is not supported.

4.5.4 Mediating effect. Identical to Shaw (2014), Variance Accounted For (VAF) factor was calculated to inspect the role played by PE as a mediator. A VAF that is higher than 80 per cent signifies full mediation, while lower than 20 per cent denotes no

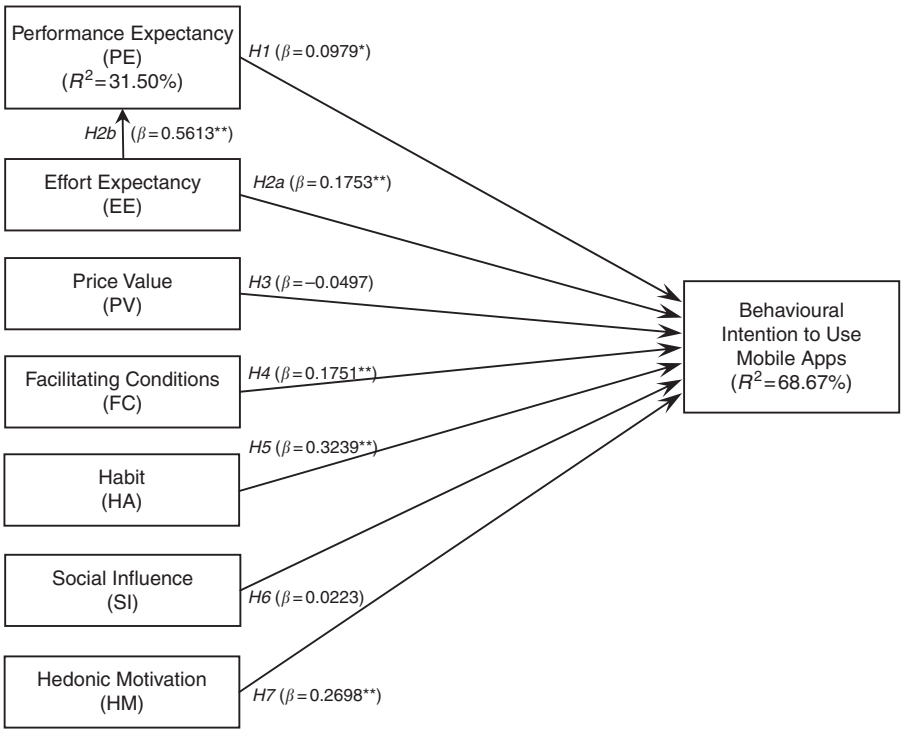

Figure 2.
The PLS-SEM results (baseline model)

mediation effects. Partial mediation is indicated by a VAF that is between 20 and 80 per cent (Hair *et al.*, 2014). Table VIII demonstrates that the mediating effect is 23.87 per cent in which the VAF falls within the range of 20-80 per cent; and thus, it has partial mediation (Hair *et al.*, 2013).

4.5.5 Predictive relevance and effect size. Table IX reported the variance explained (R^2) and predictive relevance of the endogenous latent variable. Cohen (2013) opined that the Stone-Geisser's Q^2 values of 0.02, 0.15, and 0.35 denote small, medium, and large predictive relevance. BI and PE were found to have adequate predictive relevance, as the reported Q^2 values are greater than 0.35 and 0.15, respectively. Therefore, the research model has a material predictive power in explaining BI to use mobile apps.

Effect sizes reflect the statistical power of the research model, and there are two types of them. Effect size (f^2) assesses the extent of contribution an exogenous latent variable makes to the R^2 value of an endogenous latent variable. Likewise, the effect size (q^2) quantifies the degree of contribution made by an exogenous latent variable to an endogenous latent variable's Q^2 value. The effect sizes of the endogenous latent variables are measured by using blindfolding and reported in Table X. An f^2 and q^2 of 0.02, 0.15, and 0.35 indicate small, medium, and large effect size (Hair *et al.*, 2012).

4.5.6 Overall model fit. Goodness-of-fit (GoF) was measured to consider the overall fit of the research model. GoF is an index proposed by Tenenhaus *et al.* (2004), which validates the predictive performance of the model as a whole, based on both measurement and structure model's performance. GoF measures the endogenous latent

Path	BI (dependent variable) β	*t*-Value	PE (dependent variable) β	*t*-Value
PE	0.0756	1.5942	–	–
EE	0.1674**	2.8325	–	–
PV	0.1674	1.0422	–	–
FC	0.1714**	3.0120	–	–
HA	0.3300**	5.9231	–	–
SI	0.0380	1.118	–	–
HM	0.2687**	5.0872	–	–
GD	0.0406	1.367	–	–
PE × GD	0.0145	0.3341	–	–
EE × GD	−0.0040	0.1201	–	–
PV × GD	0.0081	0.2695	–	–
FC × GD	0.0713	1.4267	–	–
HA × GD	−0.0070	0.2061	–	–
SI × GD	−0.0794	1.5891	–	–
HM × GD	−0.0444	1.2206	–	–
EL	0.0084	0.3978	–	–
PE × EL	−0.0018	0.056	–	–
EE × EL	0.0065	0.1189	–	–
PV × EL	0.0483	1.5647	–	–
FC × EL	−0.0212	0.4463	–	–
HA × EL	−0.0449	1.1827	–	–
SI × EL	0.0311	1.031	–	–
HM × EL	0.0057	0.1801	–	–
GD	–	–	−0.0257	0.6662
EL	–	–	−0.0712	1.6625
EE	–	–	0.5444**	10.6184
EE × GD	–	–	0.0432	0.8793
EE × EL	–	–	−0.0728	1.1072

Notes: PE, performance expectancy; EE, effort expectancy; SI, social influence; FC, facilitating conditions; HA, habit; HM, hedonic motivation; PV, price value; BI, behavioural intention; GD, gender; gender was coded as 0 = female; 1 = male; EL, educational level; education level was coded as 1 = lower educational level; 2 = higher educational level. $^{**}p < 0.01$

Table VII. PLS-SEM results with moderators (gender and educational level)

IV	MV	DV	*a*	*b*	*c′*	VAF (%)
EE	PE	BI	0.5613**	0.0979*	0.1753**	23.87

Notes: IV, independent variable; MV, mediating variable; DV, dependent variable; PE, performance expectancy; EE, effort expectancy; BI, behavioural intention. $VAF = ab/ab+c' \times 100\%$. $^{*}p < 0.05$; $^{**}p < 0.01$

Table VIII. Variance accounted for (VAF) of the mediator variable for BI

Endogenous variable	R^2	Q^2
BI	0.6867	0.5021
PE	0.3150	0.2248

Notes: BI, behavioural intention; PE, performance expectancy

Table IX. Predictive relevance of the endogenous latent construct

	BI (dependent variable)		
	Path coefficient	f^2	q^2
PE	0.0979	0.0176	0.0036
EE	0.1753	0.0450	0.0207
PV	−0.0497	0.0064	0.0012
FC	0.1751	0.0415	0.0173
HA	0.3239	0.1679	0.0781
SI	0.0223	0.0006	−0.0008
HM	0.2698	0.1424	0.0659

Table X. Effect size

Notes: PE, performance expectancy; EE, effort expectancy; SI, social influence; FC, facilitating conditions; HA, habit; HM, hedonic motivation; PV, price value; BI, behavioural intention

variables' average R^2 and geometric mean of the average community (outer measurement model). GoF indices fall between 0 and 1, which are 0.10 (small), 0.25 (medium), and 0.36 (large) (Tenenhaus *et al.* 2004). The GoF index of the research model appears to be medium with 0.3097, which implies a good fit model.

5. Discussions

Based on the results of PLS-SEM analysis, all constructs were found to have significant and positive relationships with BI to use mobile apps, except for PV and SI. It was also discovered that gender and EL did not moderate the relationships between the constructs.

5.1 PE

PE significantly influences BI which is consistent with Luo *et al.* (2010). Consumers would use the mobile apps if they find them useful in their daily life, which is similar to Leong *et al.* (2013b), who concluded that the usefulness is one of the factors for adoption intention.

5.2 EE

The result of EE has significant effect on BI is similar with the studies conducted by Chong (2013) and Venkatesh *et al.* (2012). The result suggests that app which is easy to use would attract consumers to use them. Furthermore, the significant and positive association between EE and PE has also been confirmed, based on the studies carried out by Zhou *et al.* (2010). This result supports the statement which says that EE and PE are essentially PEOU and PU, respectively. Consumers' perception on the usefulness of apps would directly influence by the user-friendliness of the apps.

5.3 PV

The result shows an interesting fact, whereby PV could not influence BI. This is opposing to Venkatesh *et al.* (2012), and to the past literature pertaining to the perceived value by Deng *et al.* (2014). Consumers would not intended to use mobile apps even though they perceive the benefits received outweigh the monetary value paid. A possible explanation might be students are cautious in their spending.

5.4 FC

FC has significant influence on BI, which looks alike with Crabbe *et al.* (2009) and Venkatesh *et al.* (2012). If consumers have the necessary resources and supports, they will have the intention to use mobile apps. This might possibly due to proliferation of m-devices.

5.5 HA

HA has been confirmed as the most significant driver. This result is comparable to Nikou and Bouwman (2014). One possible reason is that nowadays computer softwares have well stirred into human lives, and this makes us unconsciously reliant on mobile apps too.

5.6 SI

SI has been a popular significant construct in predicting BI, as many past studies showed the association (Chong, 2013; Chong *et al.*, 2012). However, the finding showed that, SI could not influence BI to use mobile apps. Those important people surrounding a consumer could not exert influence and this insignificant influence is same as Lu *et al.* (2005). Apps developers could therefore disregard this construct in their apps development.

5.7 HM

The result shows that HM is the second-most significant construct in the model. This result is expected, as some apps are designed with fun and entertaining elements, such as games and social network apps. The similar result is found in several studies, which utilized perceived enjoyment instead of HM (Chong, 2013; Leong *et al.*, 2013b).

5.8 Moderating effects of gender and EL

Both gender and EL were unable to moderate the relationships among the constructs. Hence, all the significant constructs are applicable to both gender and education groups. The insignificant moderating role of gender is similar with Wong *et al.* (2014), who have concluded that gender does not moderate the effects of PE, EE, SI, HM, PV, and HA on BI. Besides, Li *et al.* (2014), who learnt that EL did not display moderating roles over PE, EE, and FC, supported the results as well. These outcomes are possibly attributable to the fact that majority of the target respondents belonged to Generation Y, who was born in 1980 or later (Liebowitz *et al.*, 2007), and that this generation is technologically savvy (Valentine and Powers, 2013).

6. Implications

6.1 Theoretical implications

This study builds the existing literature gaps by incorporating EL as a moderator in UTAUT2 in order to explain BI to use mobile apps. Moreover, the insignificant roles played by PV and SI in influencing BI, and the insignificant moderating effects displayed by both gender and EL, are believed to provide more insights towards existing literature.

6.2 Managerial implications

The result suggested that HA of users on using computer software would stimulate their intention to use mobile apps. In view that HA is the most significant predictor, developers should always consider this first, by referring to the common and popular computer software. Developers could either consider directly transferring the software into mobile apps, or adding in other necessary functions. For example, one could choose to transfer dictionary software into mobile app form, and integrate voice recognition function into it.

Moreover, developers should also need to address HM. Developers can consider designing a dual player mode, which links two smart devices together so that users could compete with each other. For other categories of apps, this idea could translate in the form of sharing. For instance, a camera app that can immediately offer sharing

function after capturing a photo to other smart devices nearby without the need to manually operate.

In terms of EE, developers are advised to design the user interface in a convenient way, such as placing the functional buttons within the reach of users under one hand operation. Besides, grouping buttons together is also recommended, so to make sure users are able to find them easily. Furthermore, simplicity of language is another way for effective user interface design. Developers can also consider using icons in user interface.

FC is a factor that app developers should not neglect. Developers can consider online help support, FAQs and animated tutorials to facilitate usage. Other than these, developers can also host an online forum, where users could interact with each other.

Lastly, in terms of PE, developers can always look into the daily lives of users, and see how the apps can be integrated to provide useful functions. For instance, an app for users to record events at different timings, and allows users to specify responses (e.g. enables a silent mode, automatically rejects calls, and replies messages to missed calls) for different events.

For the issue of PV, apps developers are encouraged to seek other revenue models, rather than asking consumers to buy the apps at the first sight. Developers can provide the basic functions of the apps for free, and then charge accordingly for the advance functions, or they can consider putting in advertisements in their apps as well.

7. Limitations and recommendations

Since this study is carried out in Malaysia, the results might not be applicable to other nations. It is recommended that the future study should replicate current research setting in other countries' contexts. Furthermore, it is also interesting to compare the results yielded in different countries; thus, comparison study should also be considered. On the other hand, this study is a cross-sectional study. Future study can consider on using a longitudinal method to observe the change of consumers' behaviour over time. In addition, since this study only focused on a narrow group of respondents, a wider group of respondents is encouraged in future.

8. Conclusion

This study has empirically determined the factors that lead to mobile apps usage intention. From the results, HA is the most significant predictor of BI, followed by HM, EE, FC, and lastly PE. PV, and SI, however, have non-significant relationship with BI. In addition, gender and EL were also found to be insignificant. This implies that all the significant constructs in the model are applicable to both gender groups and different education levels. The results are beneficial to mobile apps developers, as the results reflect the mind of consumers.

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