AN ANALYSIS OF THE MODERATING EFFECT OF AGE ON SMARTPHONE ADOPTION AND USE IN THE UNITED ARAB EMIRATES

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Abstract

This paper investigates the adoption of smartphones among different age groups in the youth segment of the population in the United Arab Emirates (UAE). The proposed model is based on an extension of the extended unified theory of acceptance and use of technology (UTAUT2). A total of 437 questionnaires were distributed face to face to smartphone users in Dubai. The findings showed that age is a significant moderator in the proposed model, as significant differences were found between smartphone users in the UAE aged 18–22 and those aged 23–29. Specifically, age moderated the relationship between behavioural intention and five independent factors included in the proposed model: culture-specific beliefs and values, perceived relative advantage, price value, effort expectancy, and enjoyment. In addition, age moderated the effect of habit on actual use of smartphones. Accordingly, this research provides information that can help mobile companies and developers of mobile applications to improve the way they target customers in the UAE.

Keywords Smartphone adoption, Age as a moderator, Young people in the UAE, Adoption of mobile applications, Partial least squares, UTAUT2

1. Introduction

Smartphones have been proved to be an important tool in both developed and developing countries, as they enable people to access and use mobile applications (apps) for the purposes of education, government services, banking services, shopping and playing games (Almuraqab, 2017). Shiraishi et al. (2011, p.3) define the smartphone as "A mobile phone or PHS [personal handy-phone system] that incorporates a public general-purpose operating system, to which users can freely add applications, extend functionality, or customize". These mobile services/apps have a significant influence on the use of mobile phones (Sabry et al., 2011). According to *Gulf News* (2017), the Middle East is an untapped resource for local and international application developers: many demographic segments of the population are not yet actively using mobile applications. In addition, there is a gap in the market in terms of catering for the specific needs of individuals in the Arab region (Gulf News, 2017).

The UAE was selected as 'the country young Arabs like to live in', as they see it as an ideal country with a strong economy and an outstanding infrastructure (ASDA'A Burson-Marsteller, 2014). At 83%, the UAE has the highest smartphone penetration rate in the world (GSMA, 2016). However, the rate of adoption for mobile applications is lower than that (Shabeeh, 2015). According to Shabeeh (2015), out of all Internet users in the UAE, "52 per cent use social media apps, while 45 per cent regularly watch videos on their mobile phones. The percentage of the population who play games on their mobile phones stands at 33 per cent, and nearly 31 per cent use mobile banking services". A number of studies have investigated the factors that can affect the adoption and use of individual mobile applications; for instance, mobile banking (Aboelmaged and Gebba, 2013; Ryalat, 2017), mobile government (Almuraqab, 2017) and mobile learning (Shorfuzzaman and Alhussein, 2016). However, there is a gap in the literature in terms of studying the adoption of smartphones themselves (Dennison et al., 2013). This is an important area that needs to be investigated, as individuals must interact with smartphones before they can access any of these mobile applications and services. Smartphones present tremendous opportunities for individuals, companies and the government in the UAE (Nielsen, 2014).

The existing literature is a rich source of theories of technology acceptance; for example, the technology-acceptance model (TAM) developed by Davis (1989), the (1985) theory of planned behaviour (TPB) developed by Ajzen (1985), the diffusion of innovation theory (Rogers, 2003), the unified theory of acceptance and use of technology (UTAUT) developed by Venkatesh et al. (2003), and the extended unified theory of acceptance and use of technology (UTAUT2) developed by Venkatesh et al. (2012). However, few studies have tested how these models fit different demographic profiles of consumers.

Venkatesh et al. (2003) integrated some moderators (including age, gender, experience, and voluntariness) into the original UTAUT, and Williams et al. (2015) recommended testing the UTAUT with the inclusion of demographic factors. Outside the context of the Middle East, studies have found that the behaviour of individuals in relation to smartphones varies depending on gender and age (Anshari et al., 2016). In their recent study, Venkatesh et al. (2016) reviewed the literature on the UTAUT (Venkatesh et al., 2003) and the UTAUT2 (Venkatesh et al., 2012). Venkatesh et al. (2016) evaluated how the theory had been extended in studies that were conducted between September 2003 and December 2014. Venkatesh et al. (2016) stated that there is a gap in literature on the effects of moderating factors, including age. This was also identified in a more recent study conducted by Dwivedi et al. (2017). In particular, the moderating effects of age have received relatively little attention in the literature (Tarhini et al., 2014).

Older generations are greatly influenced by younger generations. In fact, younger generations are not only early adopters but also strong influencers on users from the other age groups, especially the older generation (Mallenius et al., 2007). They can motivate older generations to use smartphones for the first time. Social influence has a stronger effect on older people than younger people (Venkatesh et al., 2003;

Mallenius et al., 2007). Even in developed countries, where a larger proportion of the population is older (Kalba, 2008), there has been an interest in studying technology adoption among younger generations (e.g. Taylor et al., 2011). This is due to two main reasons. First, younger people tend to have more interest in adopting new technologies (Aoki and Downes, 2003). Second, younger people have a strong influence on older people (Mallenius et al., 2007).

The 15–29 age group is the largest segment of the Arab population (Dhillon and Yousef, 2009; Hayutin, 2009; Kronfol, 2011; GSMA, 2013, 2014). The 2014 GSMA report states that one out of five in the region is aged 15–24 and more than 60% of the population is under the age of 30 (GSMA, 2014). Moreover, a study by Kavanaugh et al. (2012), focusing on social media via mobile phone adoption and usage in Egypt, added that 15–29 year olds form a large segment of the population of Internet users in the Arab region. The authors state:

> There is a high percentage of young people (aged 15–29) among the total population in most Middle Eastern countries, and a high proportion of Internet and social media users among young people. These two factors allow this segment of the population to draw on many online sources of information besides the more widely used mainstream media of television and newspapers (Kavanaugh et al., 2012, p.8).

In addition, young people form a large segment of the population in the UAE (UNDP, 2014). In the UAE, 51% of the population is under the age of 30 (United Arab Emirates National Bureau of Statistics, 2015). However, there is a lack of research on this segment of the population. In particular, few studies investigate the differences in smartphone adoption and use (including mobile applications) among subgroups of the main under-30 group. For example, studying the differences between the 15–22 age group, which contains mostly students, and the 23–29 age group, which includes people who are employed, who have a higher level of income and who are expected to be more responsible. Studying differences in smartphone adoption and use between these two age groups would provide a more in-depth understanding of the behaviour of young people aged 18-29 years old in terms of smartphone adoption and use.

Based on the above, this study addresses three gaps from a theoretical perspective. First, it fills the gap in research in studying young people's adoption and use of smartphones, along with different mobile applications in UAE. Second, it analyses the effects of the moderator variable age in the UTAUT2 to provide further understanding of how the model fits with individuals from different age groups. Third, it closes the gap in research on the differences between two narrower age groups in the youth segment. This study fills these gaps by investigating the adoption of smartphones and mobile applications among two different age groups in the youth segment of the population in the UAE.

This research studied the adoption and use of smartphone handsets in addition to the mobile applications that can be accessed through them in order to fully understand the impact of age. Mobile applications are developed and used for many different, but

specific, purposes; and users' adoption and usage patterns of these applications varies. Therefore, this research only studies the adoption of mobile applications in general in order to complement smartphone adoption. It does not investigate the factors that can affect each the adoption of each type of mobile application separately (for example, mobile learning, m-commerce, mobile government or mobile banking), because each of these applications may involve additional factors that are specific to its adoption. This is beyond the scope of this research and has been investigated previously; for example, in studies conducted by Alkhunaizan and Love (2012), Nassuora (2012), Al Mashaqba and Nassar (2012), AlOtaibi (2013) and Baabdullah et al. (2015).

The following sections are organised as follows. Section two presents the conceptual framework, including the main factors and the hypothesised relationships between them. Section three explains the methodology adopted in this research. This is followed by the results of the data analysis and a discussion of the findings. Finally, implications for theory and practice, conclusions, and areas for future research are provided.

2. Conceptual framework

This conceptual framework proposed in this research is based on the extended unified theory of acceptance and use of technology (UTAUT2), which was developed by Venkatesh et al. (2012). This research extends the model further. The UTAUT2 was selected for three reasons. First, it was developed specifically to fit the context of consumer adoption of technology based on as an extension of the original UTAUT (Venkatesh et al., 2003), which combined and analysed eight theories of technology acceptance that were widely acknowledged in the existing body of literature. These included the TRA (Ajzen and Fishbein, 1980), the TAM (Davis, 1989), the motivational model (Davis et al.,1992), the TPB (Ajzen, 1991), the combined TAM and TPB (known as the A-TAM) (Taylor and Todd, 1995), the model of PC utilisation (Thompson et al., 1994), the diffusion of innovation theory (Rogers, 2003), and social cognitive theory (Bandura, 1986). Later, Venkatesh et al. (2012) extended their theory (UTAUT2) for use in the context of consumer adoption of technology. The UTAUT2 combined the concepts from these eight theories, which used different labels but thematically overlapped. Second, the framework created by Venkatesh et al. (2012) was tested with actual users of mobile Internet, which is similar to the context of smartphone adoption and provides a customer perspective. Third, Venkatesh et al. (2012) suggested testing the theory in different countries. Thus, the UTAUT2 was selected to form the basis of the framework developed in this study.

The conceptual model includes the following independent factors: perceived relative advantage, effort expectancy, price value, enjoyment and habit. It includes two additional independent factors – culture-specific beliefs and values and national IT development – as proposed by Ameen and Willis (forthcoming). The dependent factors are behavioural intention and actual use. Social influence and facilitating conditions were omitted. Facilitating conditions are defined as "consumers' perceptions of the resources and support available to perform a behaviour" (Venkatesh

et al., 2012, p.159). Social influence is defined as "the extent to which consumers perceive that important others (e.g., family and friends) believe they should use a particular technology" (Venkatesh et al., 2012, p.159). Both factors were found to be insignificant in previous studies on technology adoption in Arab countries (Abu-Shanab and Pearson, 2007; Abu-Shanab et al., 2010; Al-Gahtani et al., 2007; AlImarah et al., 2013; Alkhunaizan, and Love, 2012; Al-Qeisi et al., 2014; Al-Qeisi et al., 2015; Ameen and Willis (forthcoming); Nassuora, 2012). In addition, Venkatesh et al. (2003) explain that the effect of facilitating conditions can be overridden by the presence of effort expectancy in the model, while the effect of social influence can diminish when users have a substantive experience of using a technological product. This is the case for individuals in UAE (GSMA, 2016). Thus, these two factors were excluded from the model.

The next section provides definitions of the factors of the model. It explains the hypothesised relationships between the constructs when they are moderated by age. The expected differences in the significance of the constructs among older and younger people are highlighted.

2.1 Behavioural intention (BI)

Behavioural intention is defined as "A user's readiness to carry out a particular behaviour" (Ajzen, 1991). It has been found to be significant in many theories related to technology acceptance, including the TAM (Davis, 1989), the TPB (Ajzen, 1991), the motivational model (Davis et al., 1992), the augmented theory of planned behaviour (A-TPB) (Taylor and Todd, 1995), the extended technology acceptance model (TAM2) (Venkatesh and Davis, 2000), the UTAUT (Venkatesh et al., 2003), the UTAUT2 (Venkatesh et al., 2012) and the mobile phone technology acceptance model (MOPTAM) (Van Biljon and Kotze, 2008). Behavioural intention is one of the dependent variables in this study, as it is affected by the independent variables. In the context of smartphone adoption and use in the UAE, behavioural intention was expected to have a significant effect among younger and older individuals, since the adoption rate is high for the population as a whole (GSMA, 2015; 2016). Therefore, it was hypothesised that:

H1. The effect of behavioural intention on actual use of smartphones is significant among older and younger individuals.

2.2 Perceived relative advantage (usefulness) (PRA)

Rogers (2003, p.229) defines relative advantage as "the degree to which an innovation is perceived as being better than the idea it supersedes". Moore and Benbasat (1991) suggested that the term relative advantage is more detailed and perceptive to the user than the term perceived usefulness. Based on this suggestion, Igbal and El-Gohary (2014) used the term perceived relative advantage (usefulness). This term stems from the factors perceived usefulness and performance expectancy, which have proved to

have a strong influence on behavioural intention in previous theories of technology acceptance (e.g., Davis, 1989; Venkatesh et al., 2012; Alwahaishi and Snášel, 2013).

Previous studies have shown that perceived usefulness is a significant determinant of behavioural intention (Davis, 1989; Davis and Venkatesh, 1996). Therefore, perceived relative advantage (usefulness), adapted from a study by Moore and Benbasat (1991), was expected to have a significant effect on behavioural intention in this research. Venkatesh et al. (2003) found that the effect of performance expectancy was stronger among younger individuals. Young people tend to interact with technology more than older people do (Olson, 2011). Moreover, they form a large segment of the population in the UAE, which has a high smartphone adoption rate (GSMA, 2016). Therefore, since the research targets younger people, it was expected to have a higher level of awareness of the benefits of using smartphones. Thus:

H2. The effect of perceived relative advantage (usefulness) on behavioural intention to use smartphones is stronger among younger individuals.

2.3 Effort expectancy (EE)

Effort expectancy is defined as "the degree of ease associated with consumers' use of technology" (Venkatesh et al., 2012, p.159). Effort expectancy was found to be significant in the UTAUT2 (Venkatesh et al., 2012) and other studies (e.g., Davis, 1989; Davis et al., 1992; Taylor and Todd, 1995; Venkatesh and Davis, 2000). Previous studies have found that effort expectancy, or how easy the system is to use, is more important among older individuals than younger ones (e.g., Czaja, 2007; Venkatesh et al., 2003; Venkatesh et al., 2012). This is because as age increases, paying attention to information and completing complex tasks (such as using a smartphone and mobile applications) becomes more difficult (Czaja, 2007). Thus:

H3. The effect of effort expectancy on behavioural intention to use smartphones such is stronger among older individuals.

2.4 Enjoyment (Enj)

Hedonic motivation is defined by Venkatesh et al. (2012, p.161) as "the fun or pleasure derived from using a technology". Enjoyment was expected to be important for the adoption of smartphones due to the high number of mobile applications for gaming and entertainment. It has been found to be significant in previous studies (e.g., Kamel and Farid, 2007; Nysveen et al., 2005). Enjoyment was represented by the construct hedonic motivation in the UTAUT2 (Venkatesh et al., 2012). In the context of this research, it was expected that age moderates the relationship between enjoyment and behavioural intention and that its effect is stronger among younger individuals. Younger people are more interested in using games and social media on mobile devices; in other words, they are more interested in using smartphones and mobile applications for fun (Ameen and Willis, forthcoming). Therefore, enjoyment was expected to have a more significant effect on the younger age group. Thus:

H4. The effect of enjoyment on behavioural intention to use smartphones is stronger among younger individuals.

2.5 Habit (HT)

Habit was found to be important in the UTAUT2 (Venkatesh et al., 2012). Although Carbonell et al. (2013) stated that it might not be appropriate to regard the extensive use of mobile phones as an addiction, the authors did emphasise that when a mobile phone is overused, a habit develops automatically and changes people's behaviour. The direct effect of habit on actual use (that is, without behavioural intention as a mediator) was also discussed in a study by Limayem et al. (2007). The authors stated that when habit is formed (by using technology frequently for a certain period of time in a stable environment), it becomes a key driver of actual use that can override the effect of behavioural intention (Limayem et al., 2007).

The effect of habit on behavioural intention and actual use was tested following the research carried out by Venkatesh et al. (2012). According to a Nielson report on the UAE, almost one in every two young people access the Internet via their mobile phones more than five times a day (Nielson, 2014). This means that young people may have developed habits around using smartphones. In the context of this research, age was expected to moderate the effect of habit on behavioural intention and actual use. The effect was expected to be stronger among older individuals, since they develop habits relating to the use of technology faster than younger people do (Moura et al., 2017). Thus:

H5. The effect of habit on behavioural intention to use smartphones is stronger among older individuals.

H6. The effect of habit on behavioural intention to use smartphones is stronger among older individuals.

2.6 Price value (PV)

Price value has been defined as "consumers' cognitive trade-off between the perceived benefits of the applications and the monetary cost for using them" (Venkatesh et al., 2012, p.161). Price value was found to have an important effect on behavioural intention in the UTAUT2 (Venkatesh et al., 2012). Van Biljon and Kotze (2008) explained that price value, along with infrastructure and service, are relevant to whether or not an individual adopts mobile technology. The price factor has also been highlighted in other previous studies (e.g., Alrawabdeh et al., 2012; Kalba, 2008; Kamel and Farid, 2007; Mallenius et al., 2007; UNDP, 2013). In addition, it has been found to be important for Arab users (e.g., Alrawabdeh et al., 2012; Kamel and Farid, 2007; Puumalainen et al. 2011).

The effect of price can be associated with an individual's income. According to Alrawabdeh et al. (2012), the higher the GDP per person, the lower the chance that cost will be a barrier. However, findings by Kalba (2008) suggest that GDP should not

be considered as a factor that can independently affect technology adoption. Price can still be important to consumers on a high level of income (Mallenius et al., 2007). The GDP PPP (purchasing power parity) in the UAE is USD 604.96 billion, which is one of the highest in the world (ASDA'A Burson-Marsteller, 2015). Users compare the benefits of using smartphones and applications with their cost. Venkatesh et al. (2012) found that price value is affected by age in such a way that price value has a stronger influence on the behavioural intention of older individuals. This was expected to be the case in this research: although older individuals are more likely to be employed in higher-paid roles, they are also more likely to be responsible for their families, which makes them more cautious about spending money. Therefore:

H7. The effect of price value on behavioural intention to use smartphones is stronger among older individuals.

2.7 National IT development (ND)

National IT development is defined as "specific technology policies that guide the development of information systems in a specific country together with the existing structure of computing and communication capabilities and the ability of the population to operate and utilise these capabilities. The overall construct reflects the level of support for technological development within a given nation" (Straub et al., 2001, p.9). This construct refers to a country's IT policies and technological infrastructure. It was included in the model to test the effect of national policies and ICT development on smartphone consumers' behavioural intention. National IT development was included in studies conducted by Straub et al. (2001) and Loch et al. (2003). It has been proved to be significant for individuals in Arab countries in the context of smartphone adoption (Ameen and Willis, forthcoming). A further reason for testing the effect of national IT development on actual use is that this construct was expected to affect how young people use their smartphones; for example, frequency of use and the use of different mobile applications in terms of mobile tariffs or restrictions. As younger people use technology more frequently than older people do (Alkhunaizan and Love, 2012), the effect of national IT development on behavioural intention and actual use was expected to be stronger among younger people. Thus:

H8. The effect of national IT development on behavioural intention to use smartphones is stronger among younger individuals.

H9. The effect of national IT development on actual use of smartphones is stronger among younger individuals.

2.8 Culture-specific beliefs and values (CSBV)

Culture-specific beliefs and values were found to be important in the studies conducted by Ameen and Willis (forthcoming), Hill et al. (1998), Loch et al. (2003) and Straub et al. (2001). This construct was included in the conceptual framework of this research because the characteristics of Arab culture were expected to have a significant effect on Arab users. Straub et al. (2001) contend that studying culture as a whole is

misleading, as it is too generic. Therefore, when studying how culture affects the adoption of technology, it is more accurate to use the term culture-specific beliefs and values: this indicates that the study only includes the aspects of culture that are relevant to the specific technology to be adopted. Straub et al. (2001) found that culture-specific beliefs and values affect "IT system outcomes", which the authors refer to as actual use or intention to use a technology system. Rose and Straub (1998) and Straub et al. (2001) indicated that a preference for face-to-face meetings is an important value in Arab culture.

In this research, culture-specific beliefs and values were expected to influence behavioural intention to use smartphones. For this study the preference for face-to-face versus technology-mediated meetings was selected, as this is closely related to people's decision to adopt and use smartphones. It is important to stress that communication via mobile devices is only supplementary to face-to-face communication. Straub et al. (2002) recommended studying a subset of cultural values at the individual level that are related to the key area of enquiry. Therefore, the preference for face-to-face meetings or technology-mediated meetings was tested at the individual user level. Face-to-face interaction was identified by Hill et al. (1998) as crucial for the transfer and adoption of technology in Arab countries. Therefore, it is important to understand how this can affect smartphone adoption and use in Arab culture. Because older people are less familiar with technology and use it less (Alkhunaizan and Love, 2012), it was expected that a preference for face-to-face meetings would be more prevalent among older people. In addition, the applications through which mobile-mediated meetings can take place, such as Viber, WhatsApp and Skype, are generally restricted in the UAE (Ameen and Willis, 2016). Therefore:

H10. The effect of culture-specific beliefs and values is stronger among younger individuals, as manifested in a preference for mobile-mediated meetings.

Figure 1 shows the proposed conceptual framework with age as the moderating factor.

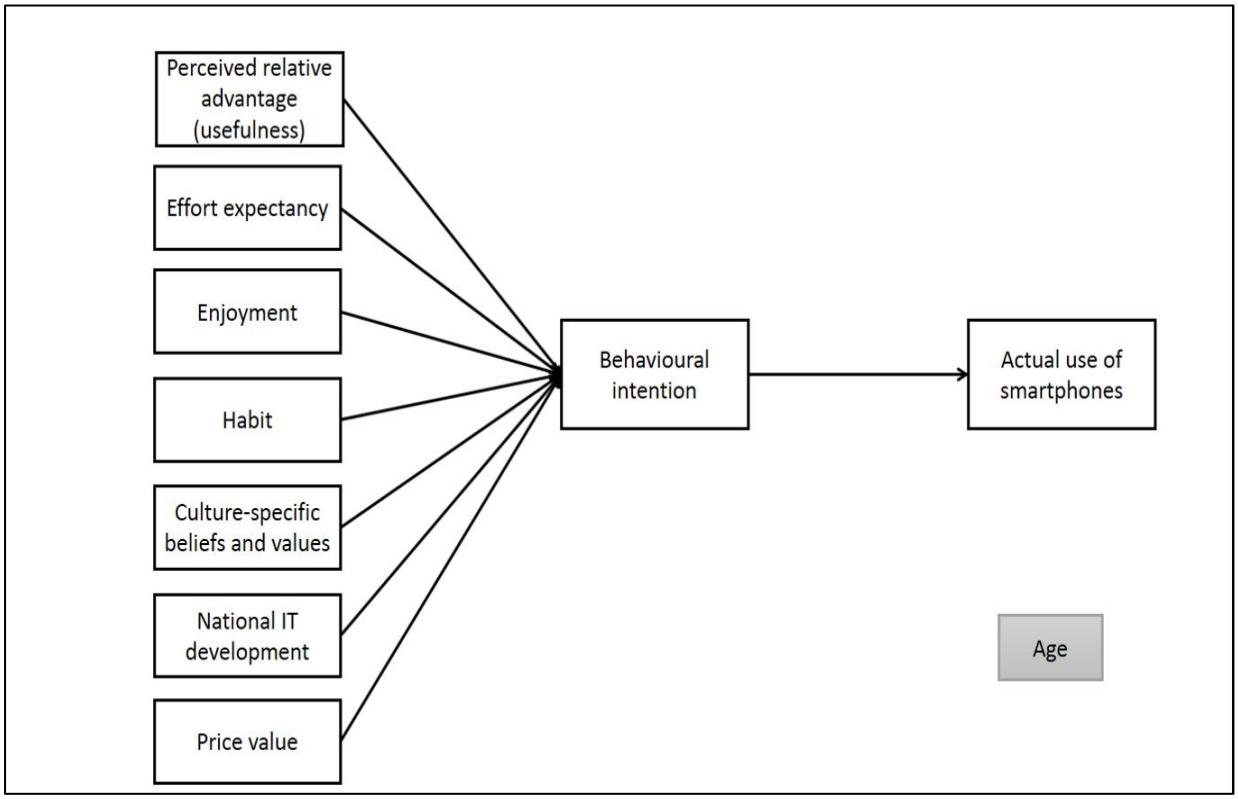

Figure 1: Proposed conceptual framework

3. Methodology

3.1 Sampling and data collection

The sample consisted of individuals aged 18–29 in households in the UAE. As mentioned previously, 51% of the population in the UAE is under the age of 30 (United Arab Emirates National Bureau of Statistics, 2015). Therefore, targeting this segment of the population is particularly important. Multi-stage cluster sampling is common in research carried out in developing countries (Yansaneh, 2005); thus, it was used in this research. This sampling technique is appropriate when no list of target units is available. We followed the probability proportional to size method proposed by Bennet et al. (1991) when selecting the districts to include in the data collection. The questionnaires were distributed face-to-face to individuals aged 18–29 in three districts of Dubai: Al-Twar, Jumeirah, and Al-Barshaa. The questionnaires were distributed in all communities in these selected districts. Based on Yamane's (1967) formula, the sample size was 400 plus 25%: 533 in total. Of these, 437 questionnaires were completed.

3.2 Survey instrument and measures

The first section of the survey included questions to gather demographic information about the respondents, including their age, gender, education, income and employment. The second section contained questions about whether respondents owned a smartphone and, if yes, what make they owned. In addition, this section

included a question about how frequently the respondents used particular mobile applications. The third section included the measures for each construct in the model. These measurement items and their sources are listed in Appendix A. Participants were asked to respond to a set of statements using a seven-point Likert scale where 1 = strongly disagree and 7 = strongly agree. This scale was used in a study by Venkatesh et al. (2012). A seven-point Likert scale has also been used in other studies on technology acceptance (e.g., Al-Gahtani et al., 2007; Malhotra and Galletta, 1999).

3.3 Analysis

The collected data were analysed using partial least squares-structural equation modelling (PLS-SEM) and SmartPLS 3.0 software. In line with the categories developed by Jarvis et al. (2003), the constructs actual use and national IT development were formative, while the remaining constructs were reflective. The data were analysed in two stages. The first stage tested the reflective measurement model and then the formative measurement model. The second stage assessed the relationships using non-parametric partial least squares-multi-group analysis (PLS-MGA).

Sarstedt et al. (2011) proposed the non-parametric confidence set approach. PLS-MGA is based on estimating the path model for each group, which is assessed using a separate bootstrap analysis (Henseler, 2012). In this approach, the analysis relies on assessing the observed distribution of the bootstrap outcomes instead of making distributional assumptions (Henseler, 2012). First, the centred bootstrap estimates of the groups are compared. Then the difference between the groups is divided by the total number of bootstrap samples. This calculates the probability that the significance in the second group is greater than in the first group. The difference is evaluated using the *p* value (Henseler, 2009). *P* values of 0.05 or lower or 0.95 or higher indicate that there are significant differences between the paths in the groups (Henseler et al., 2009). PLS-MGA is a non-parametric approach and includes a set of different techniques to compare PLS model estimates (Hair et al., 2014). Since the collected data were not normally distributed, this method was appropriate to compare the groups.

4. Results

4.1 Descriptive statistics

In the UAE, the sample was distributed almost evenly between the two age groups: 51.7% were aged 18–22 and 48.3% were aged 23–29. The split between the genders was also fairly even: 52.9% were male and 47.1% were female. In terms of education, 55.4% of the respondents had a bachelor's degree, 7.6% had a master's degree and 8% had a PhD. The results revealed that all the respondents were smartphone users with a high level of experience: 68% had more than ten years' experience in using smartphones, 13% had between seven and ten years' experience, and 11.4% had between five and seven years' experience. Only a small percentage had between three and five years' experience (3.9%) or less than three years' experience (3.7%).

In terms of employment status, the largest percentage of respondents were employed (53.3%). This was followed by students (34.6%). A small percentage of the participants were self-employed (5.3%) or looking for work (5.3%), while only 1.4% were unemployed and not looking for work. Only one respondent (0.2%) selected

"other". Analysing the responses to the questions about income shows that 31.1% of the respondents had an annual income of less than $10,000, 14.6% had an annual income of between $10,000 and $19,000, 20.8% had an annual income of between $20,000 and $29,000, and 21.5% had an annual income of between $30,000 and $39,000. A smaller percentage of respondents indicated that their annual income was between $40,000 and $49,000 (4.8%) and 7.1% had an income of $50,000 or more per year.

Responding to the question about smartphone types, the highest percentage of respondents reported they were using an iPhone (41.2%). This was followed by Samsung (23.3%) and Nokia (10.3%). Other smartphones included HTC (6.4%), BlackBerry (4.6%), HUAWEI (3.7%), LG (3.4%), Sony (2.7%), Lenovo (2.3%) and Motorola (0.2%). Eight respondents did not provide information about the type of smartphone they were using.

The results showed that the respondents used the following mobile applications frequently: making calls (mean = 5.38; standard deviation = 0.976), mobile applications (mean = 5.26; standard deviation = 0.891), mobile Internet (mean = 6.06; standard deviation = 1.388), mobile social media (mean = 6.02; standard deviation = 1.476), SMS or text messaging (mean = 5.69; standard deviation = 1.589), mobile email (mean = 5.58; standard deviation = 1.597) and games (mean = 5.37; standard deviation = 1.800). The respondents used mobile banking and m-commerce less frequently than they used the other applications, with a mean of 2.56 and standard deviation of 1.543 for mobile banking and a mean of 2.27 and standard deviation of 1.422 for m-commerce. The two most frequently used applications among the respondents were mobile Internet and mobile social media.

4.2 Reflective measurement model

The average variance extracted (AVE) values for all the reflective constructs were well above the threshold value of 0.50 (Hair et al., 2014). The AVE values ranged from 0.789 to 0.922. This showed satisfactory results for convergent validity. In addition, the values for composite reliability were well above 0.70, ranging from 0.918 to 0.959. Similarly, the values for Cronbach's alpha were above 0.70, ranging from 0.866 to 0.946. The values for composite reliability and Cronbach's alpha showed a high level of reliability and internal consistency among the reflective constructs for the sample. The factor loadings were also above the threshold value of 0.7 (Hair et al. 2014). Table 1 shows the results of the assessment of convergent validity and reliability.

Table 1. Assessment of convergent validity and reliability

	AVE	**Cronbach's Alpha**	**Composite Reliability**
BI	0.802	0.915	0.941
CSBV	0.825	0.894	0.934
EE	0.823	0.946	0.959
Enj	0.922	0.915	0.959

HT	0.789	0.866	0.918
PRA	0.886	0.936	0.959
PV	0.804	0.917	0.942

In terms of assessing the discriminant validity, the cross-loadings showed that each construct loaded higher on its own indicators than on the indicators of the other constructs. The results of the Fornell-Larcker criterion showed that the constructs shared more variance with their own indicators than they shared with the indicators of the other constructs (Hair et al., 2014). The correlations of each construct with its own indicators were higher than the correlations between each construct and any other construct in the model.

4.3 Formative measurements model

The first stage of assessing the formative model was to assess its collinearity. The tolerance values and variance inflation factor (VIF) values of all the formative indicators were within the normal range, with VIF values lower than 5 and tolerance values higher than 0.20 (Hair et al., 2006). Collinearity was assessed using behavioural intention as the dependent variable in linear regression in SPSS software. All the VIF values of the formative indicators were below the threshold of 5. Only two indicators had a VIF that was higher than 3: ND1 (VIF = 3.223 and tolerance = 0.310) and ND2 (VIF = 3.366 and tolerance = 0.297). The VIF values of the remaining formative indicators ranged from 1.170 to 2.253 and all tolerance values were above 0.20. The results were satisfactory, showing that collinearity was not an issue in the formative measurement model.

The second stage was to assess the significance and relevance of the formative indicators. To assess their significance, the bootstrapping procedure was run in SmartPLS software with 5,000 samples and no sign changes at a significance level of 0.05 ($p \leq 0.05$). No issues were found in the UAE sample regarding the significance and relevance of the formative indicators.

4.4 Multi-group analysis

The age variable was separated into two groups: "younger users", which contained 226 respondents aged 18–22, and "older users", which contained 211 respondents aged 23–29. The model explained 80% of the variance in BI ($R^2 = 0.800$) and 39% of the variance in USE ($R^2 = 0.394$) in the group of younger users. In the group of older users, the R^2 value for BI was 0.877 (88%) and for USE it was 0.558, which indicates that the model can explain 56% of the variance in USE among the older users. The results showed that there were significant differences between the groups in five paths: CSBV->BI ($p = 0.999$; the effect of CSBV on BI was stronger among older users), EE->BI ($p = 0.974$; the effect of EE on BI was stronger among older users), Enj->BI ($p = 0.005$; the effect of Enj on BI was stronger among younger users), PRA->BI ($p = 0.001$; the effect of PRA on BI was stronger among younger users), PV->BI (p = 0.999; the effect of PV on BI was stronger among older users) and HT->USE ($p = 0.981$; the effect was stronger among older users). Therefore, H2, H3, H4, H6 and H7 were supported. In addition, H1 was supported, as BI had a strong influence on USE in both groups.

H10, on the differences between the effect of CSBV on BI among older and younger users, was partially supported: age moderated the relationship, but it was more significant among the group of older users. On the other hand, H5, H8 and H9 were not supported: ND->BI (p = 0.212), ND->USE (p = 0.641) and HT->BI (p = 0.758).

Table 2. Summary of the moderating effect of age in the proposed model

	R^2 Younger Users	R^2 Older Users
BI	0.800 (80%)	0.877 (88%)
USE	0.394 (39%)	0.558 (56/%)

Hypothesis	Relationship	Subsample (1) Younger Users (18-22) years old				Subsample (2) Older users (23-29) years old				Path Coefficients-difference	p-Value (Younger users) vs	Results
		Path Coefficients	Standard Error	t value	p value		Standard Error	t value	p value			
H10	**CSBV -> BI**	0.035	0.024	1.464	0.144	0.999	0.082	3.065	0.002	0.217	0.999	PS
H3	**EE -> BI**	0.044	0.038	1.133	0.258	0.974	0.052	3.368	0.001	0.131	0.974	S
H4	**Enj -> BI**	0.147	0.043	3.407	0.001	0.005	0.022	0.612	0.541	0.133	0.005	S
H5	**HT -> BI**	0.091	0.047	1.926	0.055	0.758	0.045	3.007	0.003	0.045	0.758	NS
H8	**ND -> BI**	0.235	0.070	3.342	0.001	0.212	0.061	2.649	0.008	0.074	0.212	NS
H9	**ND -> USE**	0.300	0.120	2.496	0.013	0.641	0.135	2.724	0.007	0.067	0.641	NS
H2	**PRA -> BI**	0.426	0.093	4.600	0.000	0.001	0.046	2.187	0.029	0.526	0.001	S
H7	**PV -> BI**	0.149	0.046	3.235	0.001	0.999	0.088	4.667	0.000	0.264	0.999	S
H6	**HT -> USE**	0.041	0.065	0.641	0.522	0.981	0.070	1.935	0.054	0.178	0.981	S
H1	**BI -> USE**	0.431	0.169	2.547	0.011	0.280	0.141	2.141	0.033	0.264	0.280	S

*S: Supported, PS: Partially Supported, NS: Not Supported

5. Discussion

This study aimed to investigate the adoption and use of smartphones and the mobile applications that can be accessed through these devices among two age groups in the youth segment of the population in the UAE. The study provided a more in-depth understanding of these young people's adoption and usage behaviour in the context of smartphones and mobile applications. We found that age is a significant factor, as it moderates many of the relationships in our proposed model. In fact, we found that age is a significant moderator among the younger generations in the UAE, more specifically those aged 18–22 and 23–29.

The results support the findings of Venkatesh et al. (2003) and Venkatesh et al. (2012) that it is important to include moderators if we are to gain a full understanding of how models of technology acceptance fit in different contexts. The findings also address the question raised by Dwivedi et al. (2017) about whether it is important to include demographic factors as moderators in the UTAUT model.

Our findings indicate that age is a significant factor that moderates the relationship between CSBVs and BI. However, in contrast to what was hypothesised, the effects of CSBVs were stronger among older users in the youth segment. This may be due to their lifestyle, as they are working adults who might prefer to have mobile-mediated meetings to save time. The significance of EE for the group of older users is justified, as they tend to prefer tasks that are easy to do (Czaja, 2007). The effect of Enj. was more significant among the younger age group, supporting the findings of Kamel and Farid (2007), Nysveen et al. (2005) and Venkatesh et al. (2012). This indicates that this age group likes to use mobile applications that are associated with fun and enjoyment, such as mobile gaming or mobile social media.

While HT did not have a significant effect on BI, it had a significant effect on USE. Its effect was stronger among the older age group, which supports the findings of Venkatesh et al. (2012). Surprisingly, age did not moderate the relationships between ND and BI and between ND and USE. A closer examination of the results suggested that the effect of ND on both BI and USE was significant among both age groups, with no significant differences between them. The findings also emphasise the importance of ND as a factor that influences BI and USE, which supports the findings of Straub et al. (2001), Loch et al. (2003) and Ameen and Willis (forthcoming). This shows that individuals in both age groups are aware of how national IT development and policies can influence the adoption of smartphones and mobile applications. In addition, BI had a significant influence on USE in both groups, with no significant differences. The results support our hypotheses on the effects of PRA on BI among younger people in the UAE, which agrees with the findings of Venkatesh et al. (2003) and Venkatesh et al. (2012). Despite the high level of income in the UAE in general, including the respondents in this research, PV had a significant effect on BI in both age groups. However, it was more important among the older age group, as they are mature (23–29) and are more likely to be responsible for a family. This confirms the findings of the previous studies conducted by Alrawabdeh et al. (2012), Kamel and Farid (2007) and Puumalainen et al. (2011).

The findings indicate that there are differences between older and younger smartphone users in the youth segment of the population in the UAE, more specifically those aged 18–22 and those aged 23–29. These differences should be taken into consideration by mobile companies and developers of mobile applications in the UAE.

6. Implications for theory and practice

The findings have implications for academics and practitioners. First, the findings show that is important to include age as a moderating factor in models of technology adoption, because age influences the relationships between independent and dependent factors in these models. This is important even when the whole sample is made up of "young" people, as significant differences can still be found between age groups. The UTAUT model (Venkatesh et al., 2003) has been cited extensively in the existing literature, and the UTAUT2 is gaining attention and interest from many academics in the field. However, more accurate results may be gained by testing and extending the model with the inclusion of moderating factors, such as age, gender, income and education. Therefore, future studies should investigate the effects of these factors in their models.

Our findings have several implications for mobile companies and developers of mobile applications operating in the UAE. The results show that there are significant differences between different age groups among the youth segment of the population in the UAE (those aged 18–29). Although previous studies have shown that there is a preference for face-to-face meetings in Arab culture (Rose and Straub, 1998; Straub et al., 2001), our findings suggest that older individuals in the youth segment prefer mobile-mediated meetings. Therefore, enabling the use of VOIP services will allow this age group to save time and effort by holding mobile-mediated meetings. In addition, ease of use is an important factor for people in the older age group when adopting smartphones and mobile applications. Therefore, manufacturers and developers should carefully consider design and usability aspects when developing handsets and mobile applications. In addition, developers of mobile applications can target the 18–22 age group when creating applications for entertainment, as enjoyment is a significant factor for this group.

Policy makers and mobile companies need to work together to develop an effective and transparent regulatory environment and the associated policies, as the factor national IT development had a strong influence on both age groups in terms of their intention to use smartphones and their actual use of smartphones. For example, it is vital to reduce the restrictions on the use of VOIP services to enable mobile-mediated meetings, and transparency is needed in tariffs for using mobile Internet and mobile applications. This is possibly more important for older people in the youth segment, since they are more sensitive to price when choosing smartphones and mobile applications. Finally, developers of mobile applications should highlight the benefits of their applications in a more creative way that can attract this segment of the population.

7. Conclusions and future research

This research analysed the factors that can affect behavioural intention and actual use of smartphones among two different age groups in the youth segment of the population in the UAE. Our proposed model was based on an extension of the UTAUT2. Our findings suggested that there are significant differences between the two age groups compared in the study with regard to the adoption and use of smartphones and their applications.

Although this research has provided interesting and important findings, there are a number of limitations, which can be addressed in future work. This research investigated the adoption of smartphones and the mobile applications that can be accessed through smartphones. The adoption of mobile applications was analysed in general, rather than for individual types of application. Future studies can integrate the factors associated with smartphone adoption into research on the adoption of a specific mobile application.

Our research was concerned with the youth segment of the population in the UAE. Future studies can investigate the adoption and use of smartphones and mobile applications among older segments of the population and compare their results with the results of this research. In addition, this study investigated how the proposed model fits with people in different age groups. Future studies can test how the model fits with different demographic segments; for example, by using gender, education or income as moderating factors.

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Appendix A

Items for each construct and their sources

Item by variable	Source
Enjoyment	
Enj1. Using mobile phones is fun.	Venkatesh et al. (2012)
Enj2. Using mobile phones is enjoyable.	Venkatesh et al. (2012)
Enj3. Using mobile phones is very entertaining.	Venkatesh et al. (2012)
Price value	
PV1. Mobile phones are reasonably priced.	Venkatesh et al. (2012)
PV2. Mobile applications are reasonably priced.	Authors' own
PV3. My mobile phone is good value for money.	Venkatesh et al. (2012)
PV4. Mobile applications are good value for money.	Authors' own
PV5. At the current price, mobile phones provide good value.	Venkatesh et al. (2012)
PV6. At current prices, mobile applications provide good value.	Authors' own
Habit	
HT1. The use of mobile phones has become a habit for me.	Venkatesh et al. (2012)
HT2. I am addicted to using mobile phones.	Venkatesh et al. (2012)
HT3. I must use mobile phones.	Venkatesh et al. (2012)
Perceived relative advantage (PRA) (usefulness)	
PRA1. I find that a mobile phone is useful in my daily life.	Venkatesh et al. (2012)
PRA2. Using a mobile phone helps me to achieve things more quickly.	Venkatesh et al. (2012) and Moore and Benbasat (1991)
PRA3. Using a mobile phone helps me to stay connected to people.	Authors' own

PRA4. Using a mobile phone makes it easier to carry out my daily activities.	Moore and Benbasat (1991), with minor modifications
Effort expectancy (EE)	
EE1. Learning how to use mobile phones is easy for me.	Venkatesh et al. (2012)
EE2. Learning how to use mobile applications is easy for me.	Authors' own
EE3. My interaction with mobile phones is clear and understandable.	Venkatesh et al. (2012)
EE4. I find mobile applications easy to use.	Authors' own
EE5. It is easy for me to become skilful at using mobile phones.	Venkatesh et al. (2012)
Behavioural intention (BI)	
BI1. I intend to continue using mobile phones in the future.	Venkatesh et al. (2012)
BI2. I will always try to use mobile phones in my daily life.	Venkatesh et al. (2012)
BI3. I plan to continue to use mobile phones frequently.	Venkatesh et al. (2012)
BI4. I envisage using mobile phones in the future.	Authors' own
Actual usage (USE)	
The usage frequency for each of the following: a. Mobile phone (for making calls) b. SMS c. Mobile Internet d. Mobile games e. Mobile e-mail f. Mobile messaging apps (e.g., Viber, Skype, or WhatsApp) g. Mobile social media h. Mobile banking	Initially adopted from Venkatesh et al.'s (2012) study. Additional items related to mobile services are the authors' own

i. M-commerce.

Culture-specific beliefs and values (CSBV)	
CSBV1. The fact that a mobile phone supports technology-mediated meetings is an important element in its ultimate success or failure.	Originally adopted from Straub et al.'s (2001) study, with some modifications to fit face-to-face vs technology-mediated meetings and smartphone adoption
CSBV2. My focus on technology-mediated meetings is a factor in the final outcome.	Originally adopted from Straub et al.'s (2001) study, with some modifications to fit face-to-face vs technology-mediated meetings and smartphone adoption
CSBV3. I prefer technology (mobile) mediated meetings rather than face-to-face meetings.	Authors' own, based on Straub et al.'s (2001) study
National IT development (ND)	
ND1. I find that the current demand for IT is high.	Loch et al. (2003)
ND2. I find that the current supply of IT is high.	Loch et al. (2003)
ND3. Government IT initiatives in policy making are working well.	Loch et al. (2003) (with adjustments)
ND4. I find current mobile tariffs acceptable.	Loch et al. (2003)
ND5. I find that currently there are no restrictions on using different mobile applications.	Based on Loch et al.'s (2003) study with some modifications to test restrictions on mobile applications