Chapter 14
An Examination of the Role of National IT Development and Infrastructure in Models for Smartphone Adoption and Use: The Cases of Iraq, Jordan and the UAE

Nisreen Ameen and Robert Willis

Abstract This research aims to examine the effect of national IT development on Arab consumers' behavioural intention and their actual use of smartphones. This effect was compared to the effect of two factors: usefulness and ease of use. The study was conducted in three different countries, namely, Iraq, Jordan and the UAE. A total of 1264 questionnaires were collected from smartphone consumers aged 18–29 years old in the three countries. The collected data were analysed using partial least squares-structural equation modelling. The results revealed that the new proposed factor, national IT development, has a more significant effect on behavioural intention than the effect of perceived relative advantage (usefulness) and ease of use. The research provides information to academics, policy makers and mobile companies operating in Iraq, Jordan and the UAE, enabling them to understand the perceptions of their customers of the effects of ICT development and policies on smartphone adoption and use.

Keywords TAM · National IT development · Arab countries · Smartphone adoption

14.1 Introduction

The popularity of smartphones is continuing to increase as technology continues to advance. In the Arab region, the smartphone penetration rate is expected to reach 65% by 2020 (GSMA, 2015b). Young people under the age of 30 make up more than 60% of the Arab population (GSMA, 2013), meaning that this is a significant

N. Ameen (✉) · R. Willis
Lord Ashcroft International Business School, Anglia Ruskin University, Cambridge, UK
e-mail: nisreen.ameen@pgr.anglia.ac.uk; rob.willis@anglia.ac.uk

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market with great potential. The benefits of using mobile phones in the region extend to businesses and governments, in addition to contributing to GDP (4.4% in 2013), and mobile phone use is expected to contribute further in the years to come (GSMA, 2014). However, mobile companies in Arab countries have experienced a decline in revenue since 2013 (GSMA, 2015b). These companies are striving to build a strong customer base and increase profit. The GSMA (2016) report identified that it is unlikely that mobile companies in the Middle East will retain the same level of revenues they used to obtain in the past (GSMA, 2016). This makes understanding customers' needs and preferences even more important to try to maintain or increase their revenues. Therefore, it is necessary to identify the factors that may affect existing customers' adoption and use of the new generation of mobile phones – smartphones.

In Arab countries, the development of a fully working regulatory framework is considered to be taking longer than in other markets. Market competitiveness is also still behind in comparison with other markets (GSMA, 2014; Varoudakis & Rossotto, 2004). The regulatory framework varies widely in this region (International Telecommunication Union, 2013). Unless efficient information and communications technology (ICT) infrastructure and policies are put in place, Arab consumers will not be able to exploit the full potential of their smartphones. The effective use of smartphones and mobile applications requires effective ICT policies and an infrastructure that supports mobile Internet and mobile services.

From a theoretical perspective, the technology acceptance model (TAM) was developed in the 1980s by Davis (1989) to explore the fundamental determinants of user acceptance of computers. Based on the findings of the TAM, the main determinants of technology adoption were established to be perceived usefulness (PU) and perceived ease of use (PEOU). A substantial number of studies in the existing literature suggest that, along with user intention, the two main factors of the TAM can be applied successfully to explain the acceptance and use of mobile phones (Son, Park, Kim, & Chou, 2012; Tsai, Wang, & Lu, 2011). These two factors were found in many subsequent technology acceptance theories, for example, the decomposed theory of planned behaviour (TPB) (Taylor & Todd, 1995b), the augmented theory of planned behaviour (A-TPB) (Taylor & Todd, 1995c), diffusion of innovation (DoI) (Rogers, 2003), the model of PC utilisation (MPCU) (Thompson, Higgins, & Howell, 1991), the unified theory of acceptance and use of technology (UTAUT) (Alalwan, Dwivedi, & Rana, 2017; Alalwan, Dwivedi, Rana, Lal, & Williams, 2015; Alalwan, Dwivedi, Rana, & Simintiras, 2016; Alalwan, Dwivedi, Rana, & Williams, 2016; Dwivedi, Rana, Janssen et al., 2017; Dwivedi, Rana, Jeyaraj, Clement, & Williams, 2017; Rana, Dwivedi, Lal, Williams, & Clement, 2017; Rana, Dwivedi, Williams, & Weerakkody, 2016; Venkatesh, Morris, Davis, & Davis, 2003) and the extended unified theory of acceptance and use of technology (UTAUT2) (Alalwan et al., 2017; Venkatesh, Thong, & Xu, 2012). It can be argued that most technology acceptance theories, including the TAM (Davis, 1989), assume a high level of ICT infrastructure and the availability of technology products. This is not the case in developing countries.

There is a gap in the existing technology acceptance theories in terms of considering the macroenvironment surrounding the individual users of technological products, such as national IT infrastructure and policies. The reason behind this may be that the theories were created and tested in the developed world, where the ICT infrastructure is advanced and technology products are widely available and used. This does not apply in less developed countries, more specifically Arab countries. Applying models on technology adoption that were originally developed in western countries in non-western countries should be carried out carefully (McCoy, Galletta, & King, 2007; Straub, Keil, & Bernner, 1997).

The main aim of this study is to examine the effect of national IT development on Arab consumers' behavioural intention and their actual use of smartphones. This effect will be compared to the effects of two well-known factors: usefulness and ease of use. The research is cross national, as it studies the effects of national IT development and infrastructure on the adoption and use of smartphones in three Arab countries: Iraq, Jordan and the United Arab Emirates (UAE).

This cross national research informs a gap in the existing technology acceptance theories by examining the role of national IT development and infrastructure in smartphone adoption and use in three Arab countries. Furthermore, the research is important as it integrates the new factor – national IT development – into a conceptual model on smartphone adoption and tests its significance in the model in these countries. The research reveals the level of Arab consumers' awareness of the effect of ICT development and policies on their use of the latest generation of mobile phones – smartphones. The selection in this study of the three countries, Iraq, Jordan and the UAE, adds value to the research. These three countries are different in terms of their economic, social, political and technological advancement, which makes testing the proposed model in each of them important as it reveals how the new proposed factor fits into different countries with different characteristics. The UAE is considered the most technologically advanced country in the Arab region (GSMA, 2016), Iraq is considered to be technologically behind compared to other Arab countries (GSMA, 2016), and Jordan is in the middle in terms of technological advancement. The research also provides evidence for the ongoing debate about how appropriate it is to apply models of technology acceptance that were originally developed from a western perspective in a non-western context.

14.2 Mobile Telecom Development in Arab Countries

Diab (2010) contended that the case of telecommunications companies in the Middle East is unique compared to companies in any other region in the world for three main reasons: first, the majority of the population is young; second, the Arab culture is unique; and third, the high demand in this region leads to higher adoption rates. Smartphone penetration in Saudi Arabia alone exceeded smartphone penetration in the USA in 2011 (Alkuhunaizan & Love, 2012). However, there is a lack of

recent studies that address the current situation of the telecommunications market in Arab countries (Ameen & Willis, 2016).

The GSMA (2015b) report revealed a decline in revenue for mobile companies in the Arab region. The report revealed that the reasons behind this could be the fierce competition between companies operating in the market and the unstable political and economic conditions in the region. Although it is expected that the revenue level will increase again, the increase is likely to be modest (GSMA, 2015b, 2016). There was a decline of 2.4% in revenues obtained by mobile operators in 2014 (GSMA, 2015b). In 2015, 54% of the total population of the Arab states were mobile subscribers. However, as subscriber growth has reached a high level, it is anticipated that it will slow significantly, leading to just 57% in 2020, below the global average (GSMA, 2015b). The slow growth is also a result of the unstable political and economic conditions in some countries in the region and the increased competition between mobile companies (GSMA, 2015b, 2016).

The liberalisation of the telecom market in the Middle East and North Africa (MENA) countries is still an issue due to government control (Ezzat, 2014). Ezzat (2014) described the situation of the telecom markets in the MENA countries as allowing some level of liberalisation and competition and controlling the regulators. In the majority of Arab countries, the government still has either full control or a major share in this sector (Abbasi, 2011), and it is mainly under government control (GSMA, 2014). In general, the regulatory framework is highly varied in the Arab region (International Telecommunication Union, 2013). Even with the presence of regulatory authorities, the development of ICT laws and policies is carried out by the sector's ministry in these countries, which creates inconsistency (International Telecommunication Union, 2013). Openness and competitiveness in the market are vital for increasing the usage of technology, due to their direct effect on price reduction (Varoudakis & Rossotto, 2004).

In Arab countries, developing a fully working regulatory framework is seen to be slower than in other markets. Market competitiveness is also still behind compared to other markets (Varoudakis & Rossotto, 2004). Hakim and Neaime (2014) contended that liberalisation is based on two steps, with the first being setting and implementing the right laws and regulations via an independent regulating body. This was also stated by the International Telecommunication Union (2013). The second step is the actual liberalisation process (Hakim & Neaime, 2014). Setting up the right policies remains problematic (Alrawabdeh, Salloum, & Mingers, 2012; International Telecommunication Union, 2013; UNDP, 2013). It took a long time to begin the process of liberalisation and issuing licences to more than one company in Arab countries.

Although competition is increasing in mobile markets in Arab countries, the key areas of telecoms such as international gateways and 'single wholesale networks' are still controlled by monopolists (GSMA, 2014). The process of privatisation on its own is insufficient. For privatisation to bring effective results, the presence of an independent regulatory body and competition in the market is required (Ezzat, 2014). When the government rules the regulatory body, and owns the largest telecom operator, competition cannot exist (Ezzat, 2014), and customers are at a disadvantage.

Within the context of the three countries included in this research, Iraq, Jordan and the UAE, the telecom environment and ICT policies are different. Mobile operators in Iraq have experienced the highest fall in revenues among all Arab countries, as they fell by 12% in 2014 in comparison with 2013 (GSMA, 2015b). The unemployment rate in Iraq increased from 20% in 2014 to 34% in 2015 among young people aged 15–24 years (GSMA, 2015b), which is a high increase. Smartphone penetration rate is 17% in Iraq (GSMA, 2015a). The roles of policy making and regulations have overlapped in Iraq (Best, 2011). The study conducted by Best (2011) revealed significant shortcomings in this market that are still present and need to be resolved. Overall, the country suffers from poor ICT policies and a poor regulatory environment (International Telecommunication Union, 2013). The Kurdistan Regional Government's (2011) report indicated that the Kurdistan government has set goals to make the best use of the frequencies available for mobile calls and services, to raise mobile network coverage to 90% and to increase regulations and support companies operating in the sector, in order to achieve further price reductions and an increase in service quality (Kurdistan Regional Government, 2011). However, in 2014, additional taxes on mobile and Internet usage were enforced, which significantly increased the price of using mobile phones and mobile services in the country.

Smartphones accounted for nearly a third of the total mobile connections in Jordan in 2015 (GSMA, 2015b). Jordan has a liberalised telecommunications market (Hakim & Neaime, 2014). The competition between telecommunications companies in Jordan has been high since 2005 (GSMA, 2015a). This has contributed to the fast penetration of technological products, even though Jordan is a middle-income Arab country. However, taxation is high in Jordan, with an average growth of tax burden on mobile services of 7.7% a year between 2008 and 2012 (GSMA, 2014). In fact, taxes on mobile phones and mobile services in Jordan are among the highest worldwide (GSMA, 2015b, 2016). In 2013 and 2015, new regulations for increasing taxes on mobile phones and services were launched (GSMA, 2015a). The taxes on mobile services are also high in Jordan, with an increase from 12% in 2010 on calls, SMS and mobile broadband to 26% specific taxes in 2013. Ten per cent are paid by mobile operators, in addition to the general sale tax of 16% which is applied to most products (GSMA, 2015a). This has led to a significant increase in prices, which adversely affects affordability, especially with the high unemployment level in Jordan (GSMA, 2015a).

The smartphone penetration rate in the UAE is 83%, which is among the highest worldwide (GSMA, 2015a). The telecom market in the UAE is a duopoly between two major companies (Ellam, 2008): Etisalat (Emirates Telecommunications Corporation), the dominant and major player, and du (Emirates Integrated Telecommunications Company PJSC), which started operating in 2005 (Diab, 2010; Kamli, 2012). In 2011, Etisalat had the larger mobile market share in the mobile market in the UAE (Kamli, 2012). The prices of mobile phones and their services are high. However, due to the high GDP level, a significant number of individuals own more than one mobile device (Sabri, Al-Nakeeb, & Alrawi, 2011). The Ministry of Finance owns 60% of Etisalat, the largest telecom company (Ellam, 2008). High

fees are paid in taxes and regulatory aspects by Etisalat and du (Ellam, 2008). The country is still behind in terms of creating and implementing effective ICT policies (Alfaki & Ahmed, 2013). Although the UAE's ICT infrastructure has developed significantly in recent years, it is still behind compared to other developed countries (Alfaki & Ahmed, 2013).

There are restrictions on voice over internet protocol (VOIP) applications such as Skype and Viber for Etisalat and du to keep dominating the market (Freedomhouse, 2013). A deal took place between the UAE telecom companies and Apple to disable FaceTime from all iPhones in the UAE (Freedomhouse, 2015). In 2015, Etisalat decided to make 20% of its shares available for foreign companies to purchase (Freedomhouse, 2015). In the UAE, the International Telecommunication Union (ITU) recently allowed Etisalat and du to provide prepaid packages without obtaining regulatory approval. This will allow two mobile virtual network operators (MVNOs), Virgin and Axiom Telecom, to start offering their services in the future, which should result in increased competition. Nevertheless, Etisalat and du are still mainly owned by the government and dominate the market. Table 14.1 below provides a comparison between the three countries included in the study.

This section provided a background to the status of the mobile telecom development in the Arab region in general and in the three countries included in this study. It revealed the differences between the three countries in terms of their telecom environments.

14.3 Theoretical Background

14.3.1 The Technology Acceptance Model

The technology acceptance model (TAM) was developed in the 1980s by Davis (1989). The author explored the fundamental determinants of the user acceptance of computers. The work on TAM stemmed from the theory of reasoned action (TRA) which was related to individuals' behaviour (Alryalat, Rana, & Dwivedi, 2015; Kwon & Chidambaram, 2000). It has been used by a substantial number of academics (Hong, Hwang, Hsu, Wong, & Chen, 2011; Jan & Contreras, 2011; Shih, 2004; Tsai et al., 2011) and applied to different settings. During the study, Davis (1989) tested users' acceptance of using a computerised mail system and file editor, as well as IBM PC-based graphics systems for testing the variables. Two different methods of testing took place. The study was applied in an organisational setting. The first study included 112 staff members of an organisation with 6 months experience of using the system. The second study included 40 students using the two systems for the first time. Based on the findings, the main determinants of technology adoption were perceived usefulness (PU) and perceived ease of use (PEOU). Perceived usefulness was defined as the degree to which a person believed that using a particular system would enhance their job performance (Davis, 1989). PEOU was defined as the degree to which a person believed that using a particular system would be free

Table 14.1 Comparison of the countries included in the study

	Iraq	Jordan	UAE
Population(ASDA'A Burson-Marsteller, 2015)	34.8 m	7.5 m	9.4 m
GDP-PPP (ASDA'A Burson-Marsteller, 2015)	494.5 (USD billion)	80.2 (USD billion)	604.96 (USD billion)
Number of mobile cellular subscriptions (per 100 people) (World Bank, 2016)	95	148	178
Smartphone adoption (GSMA, 2015a)	17%	30%	83%
Development of new technologies	No	Yes	Yes
ICT infrastructure	3G – Iraq is behind compared to other countries included in the study as it has only been launched recently	4G – Jordan is advanced in terms of mobile networks	4G – UAE is advanced in terms of ICT infrastructure
Type of user (Brach, 2010)	Isolated users: They tend to have less interaction with technology. This is due to the several wars the country has been through and the severe political and economic situation in the country	Integrated users: They are more open to technology than isolated users, although not as open as the 'consumers' category of users in the UAE	Consumers: They are open to technological advancements
Competition	Competition	Competition	Duopoly
Policies	Poor ICT policies and regulatory environment. Compared to the other countries included in the study, Iraq is behind in terms of the regulatory environment. Major issues in the area of mobile taxation	High regulatory and legal framework. One of the most liberalised ICT markets compared to the other countries. However, there are gaps and major issues in the area of mobile taxation	The country is still behind in terms of creating and implementing effective ICT policies

of effort (Davis, 1989). The findings indicated that PU was a stronger driver of technology adoption. PU and PEOU affect an individual's attitudes towards using technology systems which, in turn, are a major determinant of actual system usage (Davis, 1989). Overall, TAM could explain 40% of the variance in use.

Davis, Bagozzi, and Warshaw (1989) compared TAM to TRA (Fishbein & Ajzen, 1975) in terms of intention prediction. The authors found that TAM can work better in terms of technology adoption, as it is less complex than TRA and less costly. TAM is one of the most robust models and has been validated by a significant number of studies due to its power for predicting technology adoption (Saloman &

Salman, 2013). Mathieson (1991) compared TAM to TPB (Ajzen, 1985), which was also similar to TRA (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975) with minor differences. The results of the research showed that both models can explain and present intention to use the system. Whilst TAM is simpler and less costly, TPB can explain user intention further and provide more accurate information, due to its complexity (Mathieson, 1991).

PU is a significant determinant of technology adoption (Davis, 1989; Davis et al., 1989; Igbaria, Parasuraman, & Baroudi, 1996; Taylor & Todd, 1995a, 1995c). It was also found to be the most significant determinant of behavioural intention towards camera mobile adoption (Rouibah, Abbas, & Rouibah, 2011). In fact, it was found to be more significant than PEOU in many studies (e.g. Keil, Beranek, & Konsynski, 1995; Son et al., 2012). However, Igbaria, Zinatelli, Cragg, and Cavaye (1997) found that during the systems use life cycle, there are some points (precisely when starting to use the system) where PEOU has a more significant effect on usage than PU. Karahanna and Straub's (1999) findings were also consistent with these findings. The authors emphasised that training and support are important only at the beginning and then their effect starts to diminish gradually as experience increases. PU is certainly one of the most significant factors in TAM. However, the level of its significance in comparison with PEOU changes at the different points of system use. The two factors were constantly present in the main technology acceptance theories that were subsequent to TAM (as shown in Table 14.2 below).

TAM has been used extensively within the context of technology adoption in Arab countries; more specifically, it has been used within the context of mobile services adoption in Arab countries. Rouibah and Abbas (2010) studied the acceptance of camera mobile phones in Kuwait. The authors found that factors such as personal innovativeness, attachment motivation and subjective norms had a significant impact on the acceptance of camera mobile phones. Awwad and Ghadi (2010) investigated the factors affecting the adoption of mobile banking in Jordan using a sample of customers of Jordanian banks. The authors found that complexity, compatibility, trialability and perceived risk were vital factors for the adoption of mobile banking in Jordan. Surprisingly, usefulness was not important. The authors stated that the reason behind this may be that mobile banking adoption in Jordan is still relatively new so consumers were not yet aware of its advantages. Khraim, Al-Shoubaki, and Khraim (2011) explored the factors affecting mobile banking adoption in Jordan. The authors found that the factors including relative advantage, compatibility, complexity, trialability and risk and self-efficacy apply to the Jordanian consumers' adoption of mobile banking. Abbas (2014) investigated smartphone adoption in Kuwait. The author used the extended technology acceptance model (TAM2), which was developed by Venkatesh and Davis (2000), to develop the model. The author found that the factors PEOU and attachment motivation had a significant effect on behavioural intention, while subjective norms and PU did not have a significant effect on intention. However, the factors PU and PEOU were found to affect mobile phone technology adoption, and they were found to be related to the adoption of all mobile services in a study conducted by Nassuora (2013). TAM constituted the basis of theoretical models developed in many studies

Table 14.2 The presence of perceived usefulness and perceived ease of use in existing technology acceptance theories

Theory	Authors	Usefulness	Ease of use
Technology acceptance model (TAM)	Davis (1989)	Perceived usefulness: 'The degree to which a person believes that using a particular system would enhance his or her job performance' (Davis, 1989, p. 320)	Perceived ease of use: 'The degree to which a person believes that using a particular system would be free of effort' (Davis, 1989, p. 320)
Theory of planned behaviour (TPB)	Ajzen (1991)	No	No
Model of PC utilisation (MPCU)	Thompson et al. (1991), Thompson, Higgins, and Howell (1994)	Job fit (the level to which the use of PCs can help to support the performance of the individual's job): Defined as 'the extent to which an individual believes that using [a technology] can enhance the performance of his or her job' (Thompson et al., 1991, p. 129)	Complexity (negative relationship between complexity and usage), stemmed from Rogers and Shoemakers (1971): 'The degree to which an innovation is perceived as relatively difficult to understand and use' (Thompson et al., 1991, p. 128)
Motivational model (MM)	Davis, Bagozzi, and Warshaw (1992)	Extrinsic motivation 'is perceived to be instrumental in achieving valued outcomes that are distinct from the activity itself, such as improved job performance, pay, or promotions' (Davis et al., 1992, p. 1112)	No
Social cognitive theory (SCT)	Bandura (1986), Compeau and Higgins (1995)	Performance outcome expectations: (related to job outcomes) defined as 'the performance-related consequences to the behavior. Specifically, performance expectations deal with job-related outcomes' (Compeau & Higgins, 1995) Personal outcome expectations: (self-esteem and sense of accomplishment) defined as 'the personal consequences of the behavior. Specifically, personal expectations deal with the individual esteem and sense of accomplishment' (Compeau & Higgins, 1995)	Partially found in self-efficacy: 'Judgment of one's ability to use a technology (e.g., computer) to accomplish a particular job or task' (Compeau & Higgins, 1995)

(continued)

Table 14.2 (continued)

Theory	Authors	Usefulness	Ease of use
Decomposed theory of planned behaviour (DTPB)	Taylor and Todd (1995c)	Perceived usefulness: Adapted from the technology acceptance model (TAM) Davis (1989)	Perceived ease of use: Adapted from the technology acceptance model (TAM) Davis (1989)
Augmented technology acceptance model (A-tam)	Taylor and Todd (1995a)	Perceived relative advantage: Adapted from the diffusion of innovation theory (DoI) Rogers (2003)	Complexity: Adapted from the diffusion of innovation theory (DoI) Rogers (2003)
Extended technology acceptance model (TAM2)	Venkatesh and Davis (2000)	Perceived usefulness: Adapted from the technology acceptance model (TAM) Davis (1989)	Perceived ease of use: Adapted from the technology acceptance model (TAM) Davis (1989)
Diffusion of innovation (DoI)	Rogers (2003)	Relative advantage: 'The degree to which an innovation is perceived as being better than the idea it supersedes' Rogers (2003, p. 229)	Complexity: 'The degree to which an innovation is perceived as relatively difficult to understand and use' (Rogers, 2003, p. 257)
Unified theory of acceptance and use of technology (UTAUT)	Venkatesh et al. (2003)	Performance expectancy: 'The degree to which an individual believes that using the system will help him or her to attain gains in job performance' (Venkatesh et al., 2003, p. 447)	Effort expectancy: 'The degree of ease associated with the use of the system' (Venkatesh et al., 2003, p. 450)
Extended unified theory of acceptance and use of technology (UTAUT2)	Venkatesh et al. (2012)	Performance expectancy: 'The degree to which using a technology will provide benefits to consumers in performing certain activities' (Venkatesh et al., 2012, p. 159)	Effort expectancy: 'The degree of ease associated with consumers' use of technology' (Venkatesh et al., 2012, p. 159)

in the Arab region, for example, m-government in the UAE (Almuraqab, 2016), m-learning in Oman (Sarrab, Al Shibli, & Badursha, 2016), m-government in Saudi Arabia (Alotaibi, Houghton, & Sandhu, 2016) and m-banking in the UAE, in which the two factors usefulness and ease of use were found to be significant.

A substantial number of studies in the existing body of literature have suggested that the two main constructs of TAM, along with user intention, can be applied successfully to explain the acceptance and usage of mobile phones (Son et al., 2012; Tsai et al., 2011). The study conducted by Davis and Venkatesh (1996) concluded that PU and PEOU are valid and reliable. Adams, Nelson, and Todd (1992) and Davis et al. (1989) found that these two constructs are able to explain system acceptance among different applications, with PU having a stronger influence on behavioural intention (BI). This argument was supported by Davis (1993). Nevertheless, it can be argued that technology acceptance varies across different IT

systems as well as between individuals (Straub et al., 1997). PU and PEOU remained significant and empirically validated in most of these studies.

14.3.2 Cultural Influence Model for Information Technology Transfer

Straub, Loch, and Hill (2001) developed the cultural influence model for IT transfer to the Arab region. A national IT policies and technological infrastructure construct was also included but not tested. This construct was 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). Although this construct was not tested in their study, it may very well apply to the case of Arabs' use of smartphones. Without an efficient ICT infrastructure and policies in place, Arab individuals will not be able to adopt and exploit the full potential of using mobile phones. This is especially the case for the latest generation of mobile phones, smartphones, which require an effective ICT infrastructure for mobile Internet and mobile services. Loch, Straub, and Kamel (2003) provided the main measurements for the national IT policies/infrastructure construct in the model developed on cultural influence modelling and IT transfer, namely, privatisation of IT industries, perception of current demand for IT, perception of current supply of IT, software piracy enforcement, government IT initiatives, taxation of IT imports, other IT tariffs or restrictions and tax benefits for IT use.

14.4 Proposed Research Model

Despite the fact that the area of technology adoption is mature and well developed, there is a lack of theories that include national IT development as a construct that can affect customers' intention towards and use of technology. Perhaps the reason behind this is that these theories were developed and tested in the developed world where the level of ICT development and policies is well advanced. This is not the case in developing countries, in which the level of ICT development and policies is considered to lag behind. Therefore, analysing the effects of this factor on both behavioural intention and actual use is important in the case of smartphone adoption and use in Arab countries. Since the two factors PU and PEOU, which stemmed from TAM, were found significant in many subsequent theories and in studies that examined mobile application adoption, the proposed conceptual framework in this research integrated these two factors, along with behavioural intention (BI) and

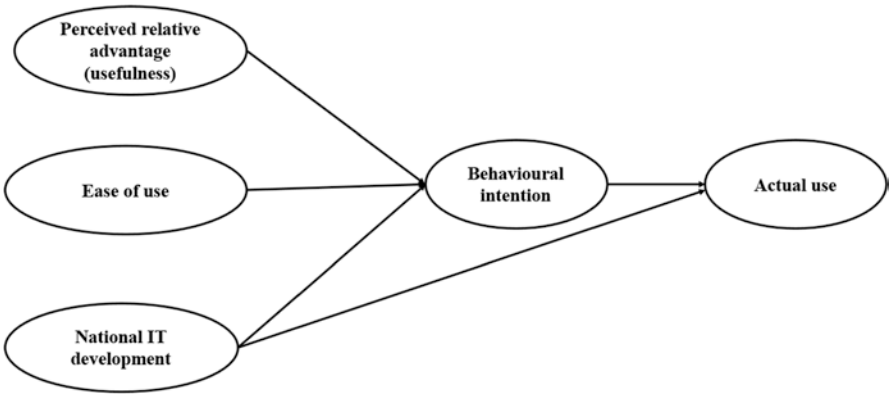

Fig. 14.1 Proposed research model

actual use (USE). In addition, this research proposes a new factor to be integrated into the proposed research model – national IT development (ND) – which was found in the studies conducted by Loch et al. (2003) and Straub et al. (2001). The literature review conducted in this research shows that this factor can be highly applicable to the case of smartphone adoption in Arab countries, more specifically, in the three countries included in the study. Figure 14.1 below shows the proposed research model.

The main factors in the proposed model and their hypothesised relationships are explained below.

14.4.1 Perceived Relative Advantage (Usefulness) (PRA)

Perceived relative advantage (PRA) usefulness stems from perceived usefulness, which proved to be important in previous technology acceptance studies (e.g. Alwahaishi & Snášel, 2013; Davis, 1989; Venkatesh et al., 2012). Previous studies showed that usefulness was found to be a significant determinant of BI (Adams et al., 1992; Davis, 1989; Davis & Venkatesh, 1996). Similarly, PRA adapted from Moore and Benbasat's (1991) study was expected to have a significant effect on BI in this study. Rogers (2003, p. 229) defined relative advantage as 'the degree to which an innovation is perceived as being better than the idea it supersedes'. Wang, Meister, and Wang (2011) studied the relationship between PRA and PU. They stated that the two terms are usually used interchangeably when studying the adoption of technology. However, relative advantage is more accurate, as it includes other competing technologies, too, especially the idea that smartphones and their services have other ICT rivals. Following the approach of Igbal and El-Gohary (2014), substituted perceived usefulness by perceived relative advantage (PRA) (usefulness) based on the findings of the previous research carried out by Moore and

Benbasat (1991), the authors suggested that the term 'relative advantage' is more detailed and perceptive to the user. In this research, the term 'perceived relative advantage' was used to represent usefulness as it is more specific. Therefore, the following hypothesis was developed:

H1 Perceived relative advantage (usefulness) has a positive significant effect on behavioural intention to use smartphones.

14.4.2 Ease of Use (EOU)

Ease of use (EOU) was found to be significant in previous studies (e.g. Davis, 1989; Davis et al., 1992; Rana & Dwivedi, 2016; Rana, Dwivedi, & Williams, 2013; Taylor & Todd, 1995a, 1995c; Venkatesh & Davis, 2000; Venkatesh et al., 2003, 2012). Within the context of young users in Arab countries, EOU was expected to be important. It was originally found in TAM as PEOU and complexity in MPCU (Thompson et al., 1991) and DoI (Rogers, 2003). Although EOU was not significant in some studies (e.g. Aboelmaged & Gebba, 2013; Terzis & Economides, 2011; Wu, Chen, & Lin, 2007), it proved to be significant in a high number of studies, in particular for mobile phone technology (Carlsson, Carlsson, Hyvönen, Puhakainen, & Walden, 2006; Jaradat & Al-Rababa, 2013). Complexity was considered as an obstacle to ICT adoption in many studies (e.g. Awwad & Ghadi, 2010; Khraim et al. 2011; Rogers, 2003; Thompson et al., 1991; Van Biljon & Kotze, 2008). Within the low level of education and technological awareness in the Arab countries, EOU was expected to be a significant factor that influences the individual user's current and future behaviour towards smartphone adoption. Within the existing body of literature related to technology adoption, EOU was found to be particularly important at the beginning of the system use, decreasing as the individual's level of experience of using the system increases (Davis et al., 1989; Karahanna & Straub, 1999). Thus, it was hypothesised that:

H2 Ease of use has a positive significant effect on behavioural intention to use smartphones.

14.4.3 National IT Development (ND)

The present framework included a new construct called national IT development (ND). The construct refers to national IT policies and technological infrastructure. This included the analysis of the effect of policies and development of ICT systems in an Arab country on consumers' BI towards usage. Straub et al. (2001, p. 10) stated 'The overall construct reflects the level of support for technological development within a given nation'. The items for this construct were added in Loch et al.'s (2003) study, namely, privatisation of IT industries, perception of current demand

for IT, perception of current supply for IT, government IT initiatives, taxation of IT imports and other IT tariffs and restrictions, software piracy enforcement and tax benefits of IT use (Loch et al., 2003). Some of these items that apply to smartphone technology and the individual consumer were adopted in this research. We investigated some aspects of this construct that consumers could provide information about. We investigated the Arabs consumers' opinions about the tariffs, restrictions, taxations, privatisation and competition in IT industries and their perceptions of current supply and demand for IT. Also, the level of IT development, policies and infrastructure varies among Jordan, Iraq and the UAE. Therefore, these variations and their effect on smartphone adoption and use are expected to be revealed in more depth from the young Arabs' perspective. We hypothesised that national IT development would have a significant effect on both behavioural intention and actual use of smartphones. The reason for testing the effect of national IT development on actual use is that this construct was expected to affect how people use their smartphones, for example, the frequency of usage or the use of different mobile applications in terms of mobile tariffs or restrictions. It was hypothesised that:

H3 National IT development has a positive significant effect on behavioural intention to use smartphones.

H4 National IT development has a positive significant direct effect on actual use of smartphones.

14.4.4 Behavioural Intention (BI)

The research framework included behavioural intention (BI) to mediate between the independent variables in the model and actual use (USE). Behavioural intention was found to be significant in many theories related to technology acceptance including TRA (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975), TAM (Davis, 1989; Rana & Dwivedi, 2015), TPB (Ajzen, 1991), DTPB (Taylor & Todd, 1995c), A-TAM (Taylor & Todd, 1995b), TAM2 (Venkatesh & Davis, 2000), UTAUT (Venkatesh et al., 2003), UTAUT2 (Venkatesh et al., 2012) and MOPTAM (Van Biljon & Kotze, 2008). Based on Ajzen's (1991) definition, we define behavioural intention within the context of our research as 'the Arab users' intention to continue to use smartphones'. Therefore, it was hypothesised:

H5 Behavioural intention to use smartphones has a positive significant direct effect on actual use of smartphones.

14.5 Methodology

As this research is concerned with the Arab region, we collected data from three Arab countries: Iraq, Jordan and the UAE. Iraq forms the third largest mobile market in the Arab region (GSMA, 2014). However, the country is lagging behind in terms of technology, and there is a lack of research on technology adoption in general, and smartphone adoption in particular, in Iraq. Furthermore, mobile companies in Iraq have experienced the highest drop in revenue in the Arab region (GSMA, 2015b). In terms of the level of mobile phone adoption, Jordan falls between Iraq and the UAE. Although there is a high level of unemployment among young people in Jordan, the level of mobile phone adoption is high in comparison with other Levant countries. Mobile operators in Jordan have also experienced a decline in revenue in the last few years (GSMA, 2015a). The UAE is the most advanced Arab country in terms of mobile phone adoption and penetration (GSMA, 2016). In fact, it has one of the highest mobile adoption levels and smartphone penetration rates in the world (GSMA, 2016). The inclusion of these three countries in the research made it possible to assess the significance of national IT development in different countries with different characteristics in terms of economic and technological development. To fully understand how the factor national IT development fits in the model, it is important to test its significance in Arab countries that vary in terms of advancement of ICT infrastructure and policies. Therefore, the three countries included in this research to test the model were different: Iraq, which is technologically behind; the UAE, which is the most advanced Arab country in terms of ICT infrastructure; and finally Jordan, which ranks in the middle in terms of ICT policies and infrastructure.

A total of 1599 questionnaires were distributed in the three countries to consumers aged between 18 and 29 years old. There were many reasons for selecting this particular age group. The segment '15–29 years old' (the youth segment) is the largest segment of the Arab population (Choueiki, 2010; Dhillon & Yousef, 2009; GSMA, 2013, 2014; Hayutin, 2009; Kronfol, 2011). The 2014 GSMA report stated that one out of five in the region is aged 15–24, and more than 60% of the population is less than 30 years old (GSMA, 2014). Another study, specifically focusing on social media via cell phone adoption and usage in Egypt (Kavanaugh et al., 2012), not only stated that 15–29-year-olds form the largest segment of the Arab population but that they also form a large segment of Internet users. The authors stated, '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 Iraq (UNDP, 2014a), Jordan (UNDP.org, 2013) and the UAE (UNDP, 2014b).

Multistage cluster sampling was used. This took place over five main stages:

Stage one: three Arab countries were selected – Iraq, Jordan and the UAE.

Stage two: a major city in each country was selected as an urban area.
Stage three: three districts from each selected city were selected randomly.
Stage four: all subdistricts of each district were included.
Stage five: households with an individual aged 18–29 years old were selected randomly.

The questionnaires were distributed face-to-face in households in major cities in each of the three countries: Erbil in Iraq, Amman in Jordan and Dubai in the UAE. Five hundred thirty-three questionnaires were distributed face-to-face in each of the three countries. A total of 1264 completed questionnaires (398 from Iraq, 429 from Jordan and 437 from the UAE) were included in the analysis after assessing the responses for missing data and unengaged responses. The response rate was 75% in Iraq, 80% in Jordan and 82% in the UAE. The face-to-face distribution of the questionnaires helped to reach a high response rate.

The collected data were analysed using partial least squares-structural equation modelling (PLS-SEM). There were two reasons for selecting PLS-SEM as a method of analysis. First, the collected data were not normally distributed. Being a non-parametric data analysis method, PLS-SEM was an appropriate choice. Second, the proposed model included two formative constructs including national IT development and actual use. The collected data were analysed using the newest version of SmartPLS (SmartPLS 3.0). The items of actual use were adopted from Venkatesh et al.'s (2012) study. This construct was acknowledged as being formative by Venkatesh et al. (2012). In addition, we applied Jarvis, MacKenzie, and Podsakoff's (2003) criteria for assessing the type of each construct – formative or reflective. The results of the assessment showed that while PRA, EOU and BI are reflective constructs, USE and ND are formative constructs.

The questionnaire included questions asking the participants about their demographic information. The second section asked the participants whether they owned a smartphone and the frequency of their use of smartphones and mobile applications; this was followed by the item for each construct. The use of a seven-point Likert scale, as a minimum, was recommended by Foddy (1994) as it increases the validity and reliability of the scale. Based on this recommendation and the extensive use of the seven-point Likert scale in previous studies including Davis (1989), Venkatesh et al. (2003, 2012), we used this scale in this research.

We assessed the model separately in each country, followed by a multigroup analysis conducted using partial least squares-multigroup analysis (PLS-MGA) to accurately test the differences between the three groups, in terms of how the model fits and the significance of the factor ND. The first stage of the analysis was assessing the measurement model including formative and reflective measurement models. The second stage assessed the structural model. Table 14.3 shows the measurement items for each construct in the proposed model and their sources. Some items were modified, and new items were added to be more applicable to the context of this research – smartphone adoption and use by Arab consumers.

14.6 Results

14.6.1 Samples Characteristics

All of the respondents were between 18 and 29 years old. In Iraq, 46.7% of the respondents were aged between 18 and 22, and 53.3% were aged between 23 and 29. The Iraqi sample was balanced in terms of gender (male, 51%; female, 49%). In Jordan, 38.9% were aged between 18 and 22, and 61.1% were aged between 23 and 29. In terms of gender, 46.9% were male, and 53.1% were female. In the UAE, the sample was distributed almost evenly among the two age groups: 51.7% were aged between 18 and 22, and 48.3% were aged between 23 and 29. In terms of gender, 52.9% were male, and 47.1% were female. All of the participants from Iraq, Jordan and the UAE owned a smartphone.

14.6.2 Reflective Measurement Model

The first stage was to assess the reflective measurement model in each of the three samples separately. This included the assessment of convergent and discriminant validity and factor loadings from each of the three samples.

In terms of the data collected from Iraq, Table 14.4 below shows that all average variance extracted (AVE) values were higher than the threshold value of 0.5 (Hair, Hult, Ringle, & Sarstedt, 2014). The AVE values ranged from 0.710 to 0.754. The Cronbach alpha (CR) values were higher than the threshold value of 0.70 (Hair et al., 2014). The CR values ranged from 0.864 to 0.909, and the composite reliability values were also higher than the threshold value of 0.70, ranging from 0.907 to 0.932.

Table 14.5 below shows the results of assessing both convergent and discriminant validities for the Jordanian sample. The AVE values ranged between 0.801 and 0.837. The CR values ranged between 0.915 and 0.942, and the composite reliability values ranged between 0.941 and 0.956.

In the UAE sample, the AVE values were higher than the minimum threshold value of 0.50, ranging from 0.802 and 0.886. The composite reliability values were higher than 0.70, ranging from 0.941 to 0.959, and CR values ranged from 0.915 to 0.946 (as shown in Table 14.6 below).

Discriminant validity was assessed by examining the cross loadings of each construct, as they should load higher on their own indicators than on the indicators of the other constructs (Chin, 1998). The second criterion for evaluating discriminant validity was the Fornell-Larcker criterion (Fornell & Larcker, 1981). In this assessment, a construct should share more variance with its own indicators than with the other constructs. The results showed that the square root of each construct's AVE was greater than its highest correlation with any other constructs in all three groups. The assessment of the discriminant validity in all three groups, using cross loadings

Table 14.3 Items for each construct and their sources, with modifications to fit the context of smartphone adoption and use

Item by variable	Source
Perceived relative advantage (usefulness) (PRA)	
PRA1. I find that a mobile phone is useful in my daily life	Davis (1989), Davis et al. (1989)
PRA2. Using a mobile phone helps me to achieve things more quickly	Davis (1989), Davis et al. (1989), Moore and Benbasat (1991)
PRA3. Using a mobile phone helps me to stay connected to people	Author's own
PRA4. Using a mobile phone makes it easier to carry out my daily activities	Davis (1989), Davis et al. (1989), Moore and Benbasat (1991), with minor modifications
Ease of use (EOU)	
EOU1. Learning how to use mobile phones is easy for me	Davis (1989), Davis et al. (1989)
EOU2. Learning how to use mobile applications is easy for me	Davis (1989), Davis et al. (1989)
EOU3. My interaction with mobile phones is clear and understandable	Davis (1989), Davis et al. (1989)
EOU4. I find mobile applications easy to use	Davis (1989), Davis et al. (1989)
EOU5. It is easy for me to become skilful at using mobile phones	Davis (1989); Davis et al. (1989)
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 to using different mobile applications	Based on Loch et al.'s (2003) study with some modifications to test restrictions on mobile applications
Behavioural intention to use the smartphone (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	Author's own
Actual use of smartphones (USE)	

(continued)

Table 14.3 (continued)

Item by variable	Source
The usage frequency for each of the following: (a) Mobile phone (for making calls) (b) SMS (c) Mobile Internet (d) Games (e) Mobile e-mail (f) Mobile messaging apps (e.g. Viber, Skype or WhatsApp) (g) Mobile social media (h) Mobile banking (i) M-commerce	Initially adopted from Venkatesh et al.'s (2012) study. Additional items related to mobile services are the author's own

Table 14.4 Assessment of convergent validity and reliability of the Iraqi sample

	AVE	Composite reliability	Cronbach's alpha
BI	0.710	0.907	0.864
EOU	0.734	0.932	0.909
PRA	0.754	0.925	0.891

Table 14.5 Assessment of convergent validity and reliability of the Jordanian sample

	AVE	Composite reliability	Cronbach's alpha
BI	0.801	0.941	0.915
EOU	0.813	0.956	0.942
PRA	0.837	0.954	0.935

Table 14.6 Assessment of convergent validity and reliability of the UAE sample

	AVE	Composite reliability	Cronbach's alpha
BI	0.802	0.941	0.915
EOU	0.823	0.959	0.946
PRA	0.886	0.959	0.936

and the Fornell-Larcker criterion, showed that the data had no issues in terms of discriminant validity. Also, all factor loadings were higher than 0.7 (Hair et al., 2006) in all groups.

14.6.3 Formative Measurement Model

The assessment of the formative measurement model was conducted using the collinearity assessment and by assessing the significance and relevance of the formative indicators. In the Iraqi sample, all of the variance inflation factor (VIF)

loadings were lower than the threshold value of 5, and the tolerance values were lower than the threshold value of 0.2 (Hair et al., 2014). The VIF values in the Iraqi sample ranged from 2.386 to 1.192, and the tolerance values ranged from 0.378 to 0.801. In the Jordanian sample, all VIF values were lower than 5, ranging from 1.353 to 3.574, and the tolerance values were higher than 0.20, ranging from 0.225 to 0.412 below. In the UAE sample, the VIF values were lower than 5, ranging from 1.153 to 3.038. Also, the tolerance values were higher than 0.20, ranging from 0.211 to 0.351.

The formative measurement model in each of the three samples was assessed in terms of the significance and relevance of the formative indicators. The outer weight is calculated using the *t* value. If the outer weight is significant, the indicator should be retained. When the indicator's outer weight is insignificant but the outer loading is high (more than 0.50), the indicator should be retained and can be considered as absolutely important rather than relatively important. On the other hand, if an indicator's weight is not significant and the outer loading is less than 0.50, the researcher should assess the significance of the indicator's outer loading. If it is significant, the researcher should decide whether to keep or delete the indicator, depending on the theory and how it supports the indicator's existence (Hair et al., 2014). If it is insignificant, the formative indicator should be deleted. The assessment of the significance and relevance of the formative indicators showed that the formative factors did not have any issues in terms of the significance of the items' weight, their loadings and the significance of their loadings in any of the three samples included in the study.

14.6.4 Structural Model

The structural model was assessed using the path analysis, effect size (f^2) and predictive relevance (q^2) (Hair et al., 2014). The structural model was calculated using the bootstrapping method (500 samples). The results in Table 14.7 below show the results of the structural model in Iraq. ND had the highest effect on BI, with a medium effect size and medium predictive relevance ($t = 4.702$, $p = 0.000$, $f^2 = 0.376$ and $q^2 = 0.200$). Therefore, H3 was supported. This was followed by EOU, with a small effect size and a small predictive relevance ($t = 3.780$, $p = 0.000$, $f^2 = 0.062$ and $q^2 = 0.090$). Thus, H2 was supported. PRA had the lowest significant effect on BI with a small effect size and a small predictive relevance ($t = 2.909$, $p = 0.004$, $f^2 = 0.036$ and $q^2 = 0.041$). Thus, H1 was supported. While BI had a significant effect on USE with a medium effect size and a medium predictive relevance ($t = 3.516$, $p = 0.000$, $f^2 = 0.208$ and $q^2 = 0.254$) and H5 was supported, ND did not have any significant effect on USE ($t = 1.698$, $p = 0.090$, $f^2 = 0.015$ and $q^2 = 0.011$). Therefore, H4 was not supported. All hypotheses were supported in the Iraqi sample, except H4 as the results showed that ND does not have a direct significant effect on USE. The R^2 for BI was 0.622 and 0.391 for USE. This indicates that the model in Iraq can explain 62% of the variance in BI and 39% of the variance in USE.

Table 14.7 Results of structural model in the Iraqi sample

	t statistics	*p* values	f^2 value	q^2 value	Hypothesis supported
BI -> USE (H5)	3.516	0.000	0.208	0.254	Yes
EOU-> BI (H2)	3.780	0.000	0.062	0.090	Yes
ND -> BI (H3)	4.702	0.000	0.376	0.200	Yes
ND -> USE (H4)	1.698	0.090	0.015	0.011	No
PRA -> BI (H1)	2.909	0.004	0.036	0.041	Yes

Table 14.8 Results of structural model in the Jordanian sample

	t statistics	*p* values	f^2 values	q^2 values	Hypothesis supported
BI -> USE (H5)	4.466	0.000	0.118	0.128	Yes
EOU-> BI (H2)	3.891	0.000	0.077	0.051	Yes
ND -> BI (H3e)	5.463	0.000	0.361	0.310	Yes
ND -> USE (H4)	3.946	0.000	0.094	0.041	Yes
PRA -> BI (H1)	3.999	0.000	0.094	0.062	Yes

In the Jordanian sample, ND had the most significant effect on BI with a high effect size and a medium predictive relevance ($t = 5.463$, $p = 0.000$, $f^2 = 0.361$ and $q^2 = 0.310$). Therefore, H3 was supported. This was followed by PRA, with a small effect size and small predictive relevance ($t = 3.999$, $p = 0.000$, $f^2 = 0.094$ and $q^2 = 0.062$). Therefore, H1 was supported. Then, EOU, with a small effect size and a small predictive relevance ($t = 3.891$, $p = 0.000$, $f^2 = 0.077$ and $q^2 = 0.051$). Therefore, H2 was supported. BI had a significant effect on USE, with a small effect size and a small predictive relevance ($t = 4.466$, $p = 0.000$, $f^2 = 0.118$ and $q^2 = 0.128$). Thus, H5 was supported. Also, ND had a significant effect on USE, with a small effect size and a small predictive relevance ($t = 3.946$, $p = 0.000$, $f^2 = 0.094$ and $q^2 = 0.041$). Thus, H4 was supported. The results in Table 14.8 below show the results of the structural model in Jordan. The results showed that all hypotheses were supported in the Jordanian sample. The R^2 for BI was 0.692 and 0.491 for USE. This indicates that the model in Jordan can explain 69% of the variance in BI and 49% of the variance in USE.

In the UAE sample, ND was the most significant factor affecting BI, with a high effect size and a medium predictive relevance ($t = 5.270$, $p = 0.000$, $f^2 = 0.347$ and $q^2 = 0.251$). Thus, H3 was supported. The second most significant factor affecting BI was PRA, with a medium effect size and a medium predictive relevance ($t = 4.423$, $p = 0.000$, $f^2 = 0.0221$ and $q^2 = 0.167$). Therefore, H1 was supported. This was followed by EOU, which had a significant effect on BI with a small effect

Table 14.9 Results of structural model in the UAE sample

	t statistics	*p* values	f^2 values	q^2 values	Hypothesis supported
Bi -> USE (H5)	5.289	0.000	0.149	0.151	Yes
EOU-> BI (H2)	3.120	0.002	0.063	0.054	Yes
ND -> BI (H3)	5.270	0.000	0.347	0.251	Yes
ND -> USE (H4)	3.558	0.000	0.071	0.041	Yes
PRA -> BI (H1)	4.423	0.000	0.221	0.167	Yes

size and a small predictive relevance ($t = 3.120$, $p = 0.002$, $f^2 = 0.063$ and $q^2 = 0.054$. Thus, H2 was supported. BI had a significant effect on USE, with a medium effect size and a medium predictive relevance ($t = 5.289$, $p = 0.000$, $f^2 = 0.149$ and $q^2 = 0.151$). Therefore, H5 was supported. ND had a significant effect on USE, with a small effect size and a small predictive relevance ($t = 3.558$, $p = 0.000$, $f^2 = 0.071$, $q^2 = 0.041$). Thus, H4 was supported. The results in Table 14.9 below show the results of the structural model in the UAE. These results showed that all hypotheses were supported for the UAE sample. The R^2 for BI was 0.694 and 0.473 for USE. This indicates that the model in the UAE can explain 69% of the variance in BI and 47% of the variance in USE.

14.6.5 Multigroup Analysis

The next stage was to critically assess the differences in terms of how the model fits in each of the three countries: Iraq, Jordan and the UAE. This was carried out using the partial least squares-multigroup analysis (PLS-MGA). The PLS-MGA is based on estimating the path model for each group which, in turn, is assessed based on a separate bootstrap analysis (Henseler, 2010). The analysis in this approach relies on assessing the observed distribution of the bootstrap outcomes instead of the distributional assumptions (Henseler, 2010). The centred bootstrap estimates of the groups are compared, and then the difference between the groups is divided by the total number of bootstrap samples to indicate the probability that the second group is greater than the first group; this is evaluated using the *p*-value (Henseler, 2010). *P*-values of 0.05 or lower and 0.95 or higher indicate significant differences between the paths in the groups.

The results of the PLS-MGA showed that there were no significant differences between the groups except differences in terms of the significance of national IT development between Iraq and Jordan ($p = 0.963$) and Iraq and the UAE ($p = 0.967$). The remaining relationships were not significantly different between the three groups (as shown in Table 14.10 below).

Table 14.10 Results of multigroup analysis using PLS-MGA

	Total effects-diff (Iraq – Jordan)	*p*-Value (Iraq vs Jordan)	Total effects-diff (Iraq – UAE)	*p*-Value (Iraq vs UAE)	Total effects-diff (Jordan – UAE)	*p*-Value (Jordan vs UAE)
BI -> USE (H5)	0.027	0.272	0.041	0.192	0.014	0.371
EOU-> BI (H2)	0.009	0.543	0.015	0.421	0.024	0.380
ND -> USE (H4)	**0.154**	**0.963**	**0.179**	**0.967**	0.075	0.176
ND -> BI (H3)	0.028	0.621	0.121	0.897	0.093	0.855
PRA -> BI (H1)	0.013	0.402	0.030	0.726	0.044	0.835

14.7 Discussion

The main aim of this research was to examine the effect of national IT development on Arab consumers' behavioural intention and actual use of smartphones and compare its significance to the significance of the two well-known factors usefulness and ease of use. The research was conducted in three different countries, namely, Iraq, Jordan and the UAE, to compare how the newly integrated factor, national IT development, would fit into the model in countries with different characteristics. The results revealed several interesting findings. The new proposed factor, national IT development, had a significant effect on behavioural intention in all three countries. This provides support to the studies conducted by Loch et al. (2003) and Straub et al. (2001).

The results of the data analysis showed that the newly integrated factor has a highly significant effect in the model in each of the three countries. In fact, national IT development was the most significant factor affecting behavioural intention and actual use of smartphones. Its significance was higher than the two TAM factors that are widely used in information systems adoption literature: usefulness and ease of use. Furthermore, the model's explanatory power was acceptable in all countries. The model's strongest explanatory power is in Jordan, in which the model is able to explain 69% of the variance in behavioural intention and 49% of the variance in actual use of smartphones. The effect of national IT development remained significant in the model in all three countries, despite the differences between them in terms of technological, economic and political factors.

Usefulness was repeatedly found as a highly significant determinant of technology adoption in previous studies (e.g. Adams et al., 1992; Alkuhunaizan and Love, 2012; Davis, 1989, 1993; Davis et al., 1989; Rouibah et al., 2011). In this research, perceived relative advantage (usefulness) was significant in the model in all three countries, but it was not the most significant factor affecting behavioural intention in any of the three countries. In addition, the findings of this research from all three

countries showed that the effect of effort expectancy has become less significant for Arab smartphone users due to the increasing level of experience they have gained from using these devices. Furthermore, the participants in all three countries were actual users with good experience levels of using smartphones. In this research, although perceived relative advantage and effort expectancy were significant predictors of behavioural intention, they were not the most significant determinants of behavioural intention in the model in the three countries. These two factors were also found in TAM (Davis, 1989), and they were widely used to study technology adoption. The results of this research show that the inclusion of other factors, more related to young Arabs in Arab countries in terms of ICT development, overrides the importance of perceived relative advantage and ease of use among actual users of smartphones. This highlights the importance of ICT infrastructure-related factors when developing or extending existing technology acceptance models in Arab countries.

The hypothesised direct impact of national IT development on behavioural intention was supported in the results from the analysis of the data collected from the Iraqi sample. Previous studies including Straub et al. (2001) and Loch et al.'s (2003) studies stressed that because of the low technological infrastructure in Arab countries, investigating the effect of national IT development and ICT infrastructure is important in these countries. The literature showed that the technological infrastructure and policy making in Iraq are behind in comparison with other Arab countries (Sanati, 2005) as there is an absence of regulations as well as an absence of an independent regulatory authority (Best, 2011; Tawfeeq, Kheder, & Qadar, 2014). The political situation in Iraq has affected the telecommunications market (International Telecommunication Union, 2013). Iraqi respondents believed that national IT development is a significant factor that can affect behavioural intention towards smartphone use in Iraq. It was expected that national IT development would have a significant effect on both behavioural intention and actual use. Surprisingly, although national IT development had a significant effect on behavioural intention, the hypothesis testing did not support the statement that national IT development has a significant effect on actual use. This can be due to the poor policy making and ICT infrastructure in Iraq, which makes it a significant predictor of behavioural intention but not actual use. The possible explanation for this is that even with the problems young Iraqi users have faced in terms of the lack of ICT policies and infrastructure, they continued using smartphones for many years so they do not find it as an issue that would stop them from using smartphones. Nevertheless, the impact of national IT development if the country is behind in terms of ICT development can be negative, and it affects the users' experience when using a system (i.e. causing an unpleasant experience when using smartphones). In the original cultural influence model for information technology transfer, Straub et al. (2001) referred to ITT/system outcomes as the intention or the actual use of technology. Within the context of the research model in Iraq, national IT development had a significant effect on behavioural intention only. This can be because users in Iraq have mostly experienced poor levels of ICT infrastructure and policy environment (Tawfeeq et al., 2014), even with the slow improvements that have recently took place in terms of network strength and speed, and they became used to this level, which

affected their views on the significance of national IT development on actual use. This indicates that the low level of ICT infrastructure and inefficiency in policy making does not necessarily mean that users will completely discontinue using smartphones in Iraq but it certainly affects their experience when using them.

National IT development was the most significant determinant of behavioural intention in the research model in Jordan. This finding indicates that young Jordanians are aware of the importance of ICT development and the policies related to ICT in smartphone adoption. Jordan is considered as one of the advanced Levant Arab countries in terms of ICT development and policy making, with high levels of competition in the market (Ezzat, 2014). The Jordanian telecommunications market is a liberalised market (Hakim & Neaime, 2014). The significance of national IT development in the model stresses the importance of improving ICT policies and development in Jordan. Competition was introduced into the market in 2005 (GSMA, 2015a), and the country enjoys fast network connectivity as 4G networks are currently in use (GSMA, 2015b). However, new rules were introduced in 2013 in terms of taxation, which led to an increase in the prices that consumers have to pay in relation to smartphones and services (GSMA, 2015a); this affects affordability.

In the model in the UAE, national IT development was the most significant predictor of behavioural intention and the second most significant predictor of actual use. The UAE is the most technologically advanced country in the Arab region (Alfaki & Ahmed, 2013). However, the country is not advanced in terms of developing ICT policies and creating real competition in the market (Alfaki & Ahmed, 2013). The two dominant companies in the mobile market are Etisalat and du (Ellam, 2008; TRA, 2014). There is a higher level of restrictions on some mobile applications in the UAE than in Jordan and Iraq. Promoting ICTs and network coverage is high in comparison with other countries in the world (TRA, 2014). The significance of national IT development on both behavioural intention (it was the most significant predictor of behavioural intention) and actual use within the model in the UAE shows that respondents are aware of the importance of national IT development in the adoption and use of smartphones both directly and via its effect on behavioural intention.

The results of this study showed that when studying technology adoption, more specifically, smartphone adoption in Arab countries, it is important to consider the macroenvironment surrounding the user. ICT development and policy making play a significant role in technology adoption in developing countries, and consumers in all three countries are aware of these effects. It confirms the significance of the new proposed factor, national IT development, on behavioural intention and actual use.

14.8 Research Limitations and Directions for Future Work

The context of this research is consumers in urban areas (major cities in three countries). Therefore, the findings cannot be generalised to include consumers in rural areas, as there are significant differences between consumers in urban areas and

those in rural areas. However, this research opens a new path for conducting future studies in rural areas in these countries. In addition, due to the lack of accurate and up-to-date data on the population of young Arabs in each selected city and district in this research, the research did not have an accurate sampling frame.

The sample size selected in this research was equal among all three countries despite the differences between them in terms of the population size. The selected sample size was appropriate for the PLS-SEM analysis, and it was consistent with the sample sizes of the majority of previous studies. However, this sample still limits the possibility of generalising the results and findings of this research.

Attitude was found to be significant in a number of existing technology acceptance theories, for example, TRA (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975), TAM (Davis, 1989), TPB (Ajzen, 1991), A-TAM (Taylor & Todd, 1995b) and DTPB (Taylor & Todd, 1995c). Venkatesh et al. (2003) found that attitude does not have a significant effect on intention. The authors stated that attitude can be found within the effects of performance expectancy (usefulness) and effort expectancy (ease of use). Our proposed model did not include attitude. However, a recent study conducted by Dwivedi, Rana, Jeyaraj et al. (2017) emphasised the significance of the inclusion of this factor in technology acceptance models. Therefore, future studies can integrate and test this factor as part of the proposed model.

In the light of both the findings and the limitations of this research, we recommend new paths for future research. We recommend that future studies should integrate our new proposed factor, national IT development, in models on technology adoption in the Arab region. This can also extend beyond the TAM. Also, future studies can add new items to the construct or amend the existing items to adapt to the technology being investigated and the country in which the research is taking place.

14.9 Implications

The findings of this research have important implications for academics, policy makers and mobile companies operating in Iraq, Jordan and the UAE. From the theoretical perspective, this research proposed and tested a theoretical model with national IT development as one of the constructs, along with the TAM model. The findings of this study advocate the importance of considering factors related to national IT development in models on technology adoption. Indeed, the high level of significance of this factor was consistent in the model in all three countries. This indicates that this factor remains important whether it is applied in a country that is considered to lag behind in technology (Iraq) or in a country that is technologically advanced (the UAE). This factor was more significant than usefulness or ease of use in all three countries. The research provides evidence that beyond the two well-known factors in the TAM, there are other, more significant, factors related to IT policies and infrastructure that should be studied and incorporated into technology acceptance models in developing countries – more specifically, Arab countries.

Williams, Rana, and Dwivedi (2015) recommended the inclusion of more than a single task when investigating technology adoption. This research included the mobile handset as well as its applications to understand how the new generation of mobile phones –smartphones – as a whole are adopted and used and to begin to understand how to adopt each single application as their uses are interlinked in various aspects. The adoption and use of the mobile handset can be affected by the mobile applications that can be accessed through it by the individual user and vice versa. Also, the adoption and use of different mobile applications and services, for example, mobile messaging applications, m-banking and m-commerce, are affected by the ICT infrastructure and policies, network strength and other factors included in this study. Therefore, the results of this research are important for researchers wishing to study the adoption of mobile applications.

From a practical perspective, this research provides important insights for policy makers and mobile companies that are operating or willing to operate in this region. The results of this research showed that young Arab consumers are highly aware of the impact of their country's IT policies and infrastructure on their adoption and use of smartphones and mobile applications. The findings of this research can assist telecommunications companies (mobile operators) in the countries included in the study to target their younger customers and increase customer satisfaction. Mobile companies, handset manufacturers and mobile application developers need to understand that beyond the two traditional factors in TAM (usefulness and ease of using smartphones), which are important, there are other, more important factors such as national IT development, which can affect smartphone and application adoption and use for young Arab users.

It is important for mobile companies, handset manufacturers and policy makers to ensure that the tariffs of mobile handsets, mobile Internet and applications are reasonable in comparison with the benefits they provide. New pricing policies related to tariffs are also required in all three countries in this research. There is a need to introduce further competition in the mobile market in the UAE. In the case of Jordan, tax reduction (in both general and specific taxes) is required. Removing any restrictions on mobile applications in the UAE is required from the consumers' perspective.

Policy makers need to ensure a transparent regulatory environment that is open and easy for consumers to understand and evaluate. These, in turn, will also contribute towards the enhancement of national IT development, which was found to be a significant factor affecting both behavioural intention and the actual use of smartphones.

14.10 Conclusion

This research proposed the integration of a new construct, national IT development, into the TAM. It also compared the significance of the new construct to the significance of the two constructs that emerged from the TAM: usefulness and ease of use.

Specifically, we modelled the national IT development construct in terms of demand of IT, supply of IT, government IT initiatives in policy making, mobile tariffs and restrictions on mobile applications. We tested the proposed model in three different Arab countries, namely, Iraq, Jordan and the UAE, using a sample of 1264 questionnaires. Our findings showed that it is important to consider the macroenvironment surrounding the individual user in terms of policy making and ICT development when the research is taking place in Arab countries. This is an important finding as such a factor has not been integrated into technology acceptance models in studies conducted in the Arab region or outside it. Our findings revealed that the new construct had a significant effect on behavioural intention in all the three countries included in the study and it had a direct significant effect on actual use in both Jordan and Iraq. The significance of national IT development exceeded the significance of both perceived relative advantage and ease of use in the model. Thus, our findings are important in terms of highlighting a new factor, more applicable to smartphone adoption in the Arab region.

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Nisreen Ameen is a researcher at Anglia Ruskin University/Cambridge and a lecturer in business information systems. Her major field of research is technology adoption and human-computer interaction.

Robert Willis is an academic and researcher at Anglia Ruskin University/Cambridge. Dr. Robert's research interests include public policy and the impact on public service delivery and innovation, sustainable business practices and strategic direction of organisations.