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Technology Adoption in Emerging Regions: Case of the Smartphone in Saudi Arabia

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This paper examines the adoption of Smartphones in Saudi Arabia. A theoretical research model is developed based on the unified theory of acceptance and use of technology. A web-based survey has been used to gather data from randomly selected Smartphone users in Saudi Arabia. For data analysis, SEM approach was followed, SPSS and AMOS were utilized for analyzing data. The results indicate that performance expectancy, effort expectancy, brand influence, perceived enjoyment, and design constructs have a positive and significant relationship with users' behavioral intention to adopt and use Smartphones in Saudi Arabia.

Keywords: Technology adoption; Smartphone; Saudi Arabia.

1. Introduction

The objectives of this paper can be summarized into the following main goals:

G1: Developing a research model that can be used to obtain a better understanding and more insights regarding the key factors that are associated with users' adoption and use of the Smartphone in Saudi Arabia. This research model is developed based on the existing IT theoretical adoption models, related adoption factors' taxonomy developed based on previous related research and

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opinions of experienced users and those who work in sectors related to Smartphone technology.

G2: Explore and better understand the key factors that may have relationships with general users' adoption and use of the Smartphone technology in Saudi Arabia based on users' perspectives.

2. Literature Review

Smartphone technology is defined in two ways: (1) as "a hand-held computer capable of multiple functions in addition to placing calls" [Kaplan (2012)]; and (2) as "a mobile phone offering advanced capabilities, often with PC-like functionality (PC mobile handset convergence)" [Santhipriya *et al.* (2011)]. Smartphone technology is based mainly on a well-integrated combination of hardware, software, and network.

Smartphone technology is a relatively new technology that is rapidly evolving and gradually impacting consumers' behavior, their daily activities, their social activities, the mobile industry, business activities, marketing, education, healthcare and more [Alwahaishi and Snášel (2013); Carayannis and Clark (2011); Rohm *et al.* (2012)]. Smartphone technology offers the potential to improve efficiency and productivity, reduce cost, improve users' satisfactions and enhance their experience in a number of related industries including healthcare, finance, ecommerce, education, entertainment, tourism [Chun *et al.* (2012); Goldman (2010); Saddik *et al.* (2012)].

Analysts project that 1,755.4 million units will be sold worldwide by 2023 [Scarsella (2019)].

2.1. *Users' adoption and use of the Smartphone technology*

Smartphone users' acceptance and behavior are considered to be key factors to continue successful growth for the Smartphone technology and its stakeholders [Dai and Palvi (2009); Tseng *et al.* (2014)]. Consequently, evaluating and better understanding the key factors that influence users' adoption and use of Smartphone technology has become more important to all stakeholders. Designers, developers, and manufacturers need to improve related products/services, and to meet consumers' expectations [Dai and Palvi (2009); Vannoy and Palvia (2010)]. Scholars from different fields and interests agree on the importance of Smartphone technology as a critical part of the evolution of the information technology domain [Chtourou and Souiden (2010)].

A number of research studies have been conducted to explore users' adoption and use of Smartphone technology. However, most of the existing empirical research focused on only a limited number of factors such as the fun aspects of using the Smartphone [Chtourou and Souiden (2010)] or the effect of the enjoyment aspect on the adoption of the Smartphone [Song and Han (2009)]. Moreover, a number of empirical studies considered the Smartphone as if it were a tool to be used in executing a specific task such as using the Smartphone in the healthcare sector [Kijsanayotin *et al.* (2009)]. Other researchers focused on a specific profession such as studying adoption of Smartphones among doctors and nurses [Park and Chen

(2007)], studying the adoption of Smartphones among employees in delivery services [Chen *et al.* (2009)] or studying the adoption and use of Smartphones among college students [Lee (2014)].

Studying only one or few factors that influence users' adoption of Smartphone technology will result in neglect of other important factors and make it harder to gain a complete perspective. It is more appropriate to examine and compare all related characteristics within the same research in a holistic and comprehensive manner [Tornatzky and Klein (1982)]. In a number of studies, scholars pointed out the important role of cultural and social factors and their influence on the adoption and use of new information technologies [Al-Gahtani *et al.* (2007); Herbig and Palumbo (1994); Straub *et al.* (1997); Straub (1994); Van and Waarts (2003)]. Saudi Arabia is a developing country and it has different social and cultural contexts. It can be characterized as a society that is relatively collectivist in nature as individuals have closer ties and high influence among and between them [Al-Gahtani *et al.* (2007)]. In a number of empirical studies, scholars studied the adoption and use of Smartphone technologies in Saudi Arabia, including the adoption of mobile internet [Alwahaishi and Snášel (2013)], adoption and use of e-services [Al-Ghaith *et al.* (2010)], and acceptance and use of IT [Al-Gahtani *et al.* (2007)]. Their results showed that a number of factors, namely social influences, facilitating conditions and language, showed significant relationships with users' adoption and use of IT in Saudi Arabia. In emerging regions, specifically Saudi Arabia, little or no effort has been made to study and explore the key factors that influence users to adopt and use the Smartphone technology. The Saudi Arabian economy is growing fast and it is supporting the significant expansion of its telecommunication sector, which has had less than 10 years of experience in an open competition market [Alwagait (2013)]. With this environment, understanding users' intention to adopt and use the Smartphone technology has become a very important factor that needs to be better understood, especially when creating and providing mobile products, services, contents, applications, and related products [Que and Hurtado (2013)]. However, there has been very little effort to empirically study the factors that influence the adoption and use of the Smartphone technology in Saudi Arabia. In fact, there does not appear to be any research that has studied these in a holistic manner.

Therefore, the main purpose of this paper is to develop a research model and to conduct empirical research to advance existing knowledge toward a better understanding of the key factors that influence users' adoption and use of the Smartphone technology in Saudi Arabia.

2.2. *Studying the adoption and use of the Smartphone and its related technologies in emerging regions*

Arpaci *et al.* [2013] investigated the impacts of cultural differences on Smartphone adoption by organizations in Canada and Turkey. Their finding showed that cultural differences have a significant influence on adoption behavior. Their results indicated that there are significant differences in factors that influence the adoption of Smartphones between countries [Arpaci *et al.* (2013)]. Alnajjar *et al.* [2013]

studied the influence of cultural and social factors on individuals' intention to adopt and use mobile commerce in Jordan. Their finding showed that cultural and social factors have positive and significant relationship with individuals' intention to adopt and use m-commerce in Jordan. A number of empirical research studies were conducted to study the key factors that influence users' adoption and use of the Smartphone and its related technologies in China, also an emerging region. In most of these studies, cultural and social influences showed a significant relationship with users' adoption and use of the Smartphone and its related technologies.

Pan *et al.* [2013] empirically investigated the key factors that influence the adoption of the Smartphone among college students in China. Their results showed that social influence has a significant and positive influence on users' adoption of the Smartphone [Pan *et al.* (2013)]. Ling and Yuan [2012] utilized the Theory of Reasoned Action (TRA) to empirically study the factors that influence users' adoption and use of the Smartphone in China and found that subjective norms were among the significant factors that have positive effects on the use of the Smartphone [Ling and Yuan (2012)]. Lai and Lai [2013] studied the factors that influence users' adoption and use of mobile commerce in China. Their results show that social influences were among the significant factors that influence users to adopt and use mobile commerce in China-Macau [Lai and Lai (2013)]. Park *et al.* [2007] empirically studied the factors that influence users' adoption of mobile technologies in China. They found that social influence shows a significant influence on users' adoption of mobile technology in China [Park *et al.* (2007)]. Pan and Marsh [2010] studied the factors that influence the older adults' adoption of the internet in China. Subjective norms were among the significant factors that influence the adoption of the internet.

Zhou *et al.* [2010] integrated the technology task fit model with the Unified Theory of Acceptance and Use of Technology (UTAUT) model to explain the key factors that influence users' adoption of mobile banking in China. Their finding indicated that social influence was among the key factors that have significant effects on user adoption of mobile banking in China. Lu *et al.* [2003] conducted an empirical study to explore the key factors that influence users' acceptance of wireless internet via mobile technology in China. Social influence and facilitating conditions were among the significant factors that influenced users' acceptance of the wireless internet via mobile technology [Lu *et al.* (2003)]. Dai and Palvi [2009] conducted a cross cultural empirical research to study the factors that influence users' adoption of mobile commerce in the United States and China. Their results showed a number of significant differences among factors that influence users' adoption of mobile commerce, which include that subjective norms showed more influence on users' adoption in China than in the United States [Dai and Palvi (2009)].

Hill *et al.* [1998] stated: "As most technology is designed and produced in developed countries, it is culturally-biased in favor of those developed countries' social and cultural systems." Also, they indicated that differences in Arabic culture and society have an influence on how new IT is accepted, viewed and utilized among users [Hill *et al.* (1998)]. Factors that influenced users' adoption and use of the Smartphone and its related technologies in other emerging regions, such as China, showed significant differences among factors based on the users' perspective and

their cultural and regional differences. As mentioned in the previous paragraph, cultural, and social factors showed a significant influence on users' adoption and use of Smartphone and its related technologies in China. Saudi Arabia is a country that is witnessing rapid development and has different cultural and social contexts, which may influence users' adoption and use of the Smartphone and its related technologies. Moreover, it has been indicated that there is a need for more empirical research to identify the key factors that influence users' behavioral intention to adopt and use the Smartphone technology in a comprehensive manner [Kang *et al.* (2011); Verkasalo (2010)]. A number of scholars mentioned the lack of research investigating the key factors that influence the acceptance and use of Smartphone technology in Saudi Arabia [Al-Meshal and Almotairi (2013); Alsenaidy and Tauseef (2012); Saddik *et al.* (2012); Seliaman and Al-Turki (2012)]. To date, there is no holistic and comprehensive empirical research regarding the key factors that influence general users' intention to adopt and use the Smartphone. Therefore, this paper aims to identify and explore the key factors that influence general users' adoption and use of the Smartphone technology in Saudi Arabia.

2.3. *Saudi Arabia: Its economy and telecom sector*

Saudi Arabia is considered to be a central pillar of Arab nations. It is located in the Arabian Peninsula in the Middle East [Alsenaidy and Tauseef (2012)] and is the largest state of the Gulf Cooperation Council (GCC) with a total area of 2,149,690 km^2 and a population of about 21 million [Alakloby (2012); Alsenaidy and Tauseef (2012); Information (2015)]. Saudi Arabia is one of the world's largest oil producers and it has about 20% of the world's proven oil reserves [Alkhathlan (2013)]. Oil export accounts for about 90% of the country's revenue, and the economy continues to improve, especially with the increase in the price of oil and the rise in demand for oil worldwide [Khatib (2012); Qobo and Soko (2010)]. The government is working toward diversifying the economy away from its reliance on oil; therefore, it is encouraging and supporting growth in the private sector [Al-Darrab *et al.* (2013)].

The Saudi government is focusing on a number of sectors to play a critical role in the economic diversification effort, including the telecommunications sector [Al-Darrab *et al.* (2013)]. Due to the continued increase in its oil production, Saudi Arabia is witnessing a continuous growth in gross domestic product (GDP) accompanied by noticeable increase in its population [Mansouri *et al.* (2013)]. The growth of GDP and the increase in population in Saudi Arabia indicates a healthy economy that holds a promising future, especially for the mobile industry.

The Saudi government's long-term vision is to transform into an information society with a global, modernized, and digital economy [Qobo and Soko (2010); Simsim (2011)]. Competition in the mobile market is a relatively new trend in Saudi Arabia as the market was monopolized by a government-owned company, Saudi Telecommunication Company (STC), until it was changed into partial competition in 2005 [Alwagait (2013)]. With this new, relatively open competition in the Saudi telecom market, understanding users and their preferences has become a very

important factor that needs to be carefully considered and better understood when creating and providing mobile products, services, contents, applications and any related products [Que and Hurtado (2013)]. Telecommunication companies in Saudi Arabia have started to partner with companies from other countries to gain competitive advantage and increase their revenue [Alakloby (2012)].

Even though Saudi Arabia's telecommunications industry is growing, it still needs improvement in many of the mobile services provided compared to other GCC countries. Saudi Arabia is the largest telecom market of all the GCC states; however, Saudi consumers spend less on telecom services compared to other countries in the GCC region as a trade-off for the limits on services [Que and Hurtado (2013)].

There are a number of existing challenges in the Saudi Arabian telecom industry. For instance, only around 8% of commercial organizations have online purchase channels that consumers can use to buy their product online, which indicates a challenge for electronic commerce including mobile commerce [AlGhamdi *et al.* (2012)]. To improve its performance, enhance users' experience and reduce cost, the government of Saudi Arabia is attempting to provide its services electronically in a number of its sectors; however, this is still in a very early stage of adoption [Alsenaidy and Tauseef (2012)]. According to the Saudi Communications and Information Technology Commission (CITC), mobile payments are considered a key challenge for electronic payment systems in Saudi Arabia [Commission (2010)]. Moreover, English language content is still considered as a challenge and the lack of Arabic content is seen as a barrier for many Saudi users to use the internet [Commission (2010)].

With the continuous evolution of Smartphone technology, mobile industry revenue has been changing: revenue from voice and texting services are shrinking while revenue from value added services and data services are rising [Kargin *et al.* (2009); Phan and Daim (2011)]. Data revenue in Saudi telecom companies' accounts for only about 15% of total revenues, which is still low compared to 40% in the developed market [Alawi *et al.* (2012)]. Electronic government services are still a new trend and it still has a number of challenges to deal with such as the lack of training and the lack of information security [Al-Fakhri *et al.* (2008)]. Better understanding of Smartphone users and their use behavior will provide meaningful advantages that can help the government, private sector, and all stakeholders to provide users with better services/products and improve their experience.

2.4. *Language, cultural differences*

Arabic is the main language of Saudi Arabia's population. Numerous scholars mentioned that lack of English language was one of the major holdups in the adoption and use of the internet and e-services in Saudi Arabia [Al-Ghaith *et al.* (2010)]. The majority of IT services' contents are designed with English version interfaces and intended mostly for English speaking consumers [Al-Ghaith *et al.* (2010)]. Even though many Saudis are eager to study and speak English, only about 10% of the Saudi population presently speaks English [Monitor (2014)]. In many

studies, scholars pointed out the important role of cultural factors and their influence on the adoption and use of new ITs [Al-Gahtani *et al.* (2007); Herbig and Palumbo (1994); Straub *et al.* (1997); Straub (1994); Van and Waarts (2003)]. Saudi Arabia has different cultural contexts than Western nations. It is characterized as a society that is more collectivist in nature. Individuals and families have closer ties resulting in high influence among and between them [Al-Gahtani *et al.* (2007)]. Al-Gahtani *et al.* [2007] studied the effects of the cultural aspects on the acceptance and use of IT in Saudi Arabia. They found that subjective norms positively influence users' intention to use IT.

Around 22% of Saudi people have a bachelor's degree, approximately 1% have a master's degree and about 0.5% have a Doctorate [Information (2014)]. Higher education and academic research are very important aspects that the government of Saudi Arabia is pursuing and highly encouraging, especially in recent years [Stephens *et al.* (2008)]. Nevertheless, there is less effort spent on academic research at the graduate level and the connection between the private sector and academic institutions in Saudi Arabia is very poor [Krieger (2007)]. There is an obvious need for academic research at the graduate level that addresses the problems, challenges, and benefits in Saudi society [Stephens *et al.* (2008)].

In recent years, the government has been working to fulfill the need for graduate level research in Saudi Arabia with special emphasis on science and technology. This can be seen in a number of steps taken by the government to encourage and obtain good quality research, including starting the King Abdullah Program for Scholarship in countries around the world [Alamri (2011)]. There are around 111,000 Saudi students in the United States [News (2015)]. Moreover, Saudi Arabia established a new graduate level research university, King Abdullah University of Science and Technology (KAUST). Its budget is only exceeded by that of Harvard University and it has gained a well-known reputation in specific research fields around the world in a short time [Luqman (2013)].

Adams *et al.* [2011] explored the research challenges in a number of Middle Eastern countries including Saudi Arabia. They indicated that there is a notable growth in academic research in a number of countries in the region including Turkey and Iran. However, in Saudi Arabia, academic research activity is still very low and there is a need for improvement. Also, some of these sources mentioned the importance of strong research to improve and develop a more robust education system that benefits the society, especially with the availability of rich human capacity and other resources [Adams *et al.* (2011)].

Providing Smartphone technology to end users requires a great deal of cooperative work and effort that involves many stakeholders, including services providers, device providers, software developers, content developers operating systems/platforms developers and more. Even with highly designed and advanced technology, users' acceptance is still a very important key that determines its success [Dillon and Morris (1996)]. Saudi Arabia has different cultural and social contexts, which many influence users differently, therefore understanding users' perspectives of the Smartphone plays a key role in developing and providing more successful and more valuable Smartphone products and services [Que and Hurtado (2013)]. Numerous

scholars mentioned the lack of research that investigates and explores the key factors that influence the acceptance and use of Smartphone technology in Saudi Arabia in a holistic manner [Al-Meshal and Almotairi (2013); Alsenaidy and Tauseef (2012); Saddik *et al.* (2012); Seliaman and Al-Turki (2012)]. Therefore, the aim of the paper is to explore and study the key factors that influence general users' adoption and use of the Smartphone technology in Saudi Arabia.

3. Methodology and Theory Development

Scholars' interest in studying and understanding users' adoption and use of new IT at both the organizational level and the individual level has been evolving for decades [Moore and Benbasat (1991)]. With the evolution of IT, a number of theories have been developed and modified to better study and understand users' acceptance and use of new IT. Dillon and Morris [1996] defined users' acceptance as "the demonstrable willingness within users group to employ information technology for the tasks it is designed to support." Rogers [2003] defined diffusion of innovation as "Diffusion is the process by which an innovation is communicated through certain channels over time among the members of a social system." Moreover, 10 characteristics were specified by Tornatzky and Klein [1982], including the five that were identified by Rogers, they added five more attributes namely: cost, communicability, divisibility, profitability, and social approval. Alavi and Joachimsthaler [1992] mentioned that, cognitive style, personality, demographic, and user situational variables are the most relevant user factors that can help to determine the acceptance of technology. As information technologies evolve and the nature of each technology changes, theories of IT adoption evolves as well. In attempt to better understand, predict, and explain users' adoption and use of new technologies in both the organization's level and in the individual's level, a number of theoretical models were introduced, developed, and tested.

3.1. *Selection of a suitable model*

Today's ITs such as the Smartphone and its related technologies are developing at a fast rate. Thus a great effort has been made to develop a more reliable and comprehensive theoretical model that can explain and predict users' adoption and use of IT. It is observed from this literature review that theoretical models have been developed to gain better results and account for the changes in technologies and users' behaviors. Older model such as TRA play a big role in the development of the next models as shown in Table 1. As shown in Table 1 many of the newer IT theoretical models such as UTAUT are based on derivations from older models, and consist of more and improved factors that make them more mature and more suitable for the study of the newer technologies such as the Smartphone and its related technologies. Table 1 lists a number of relevant IT adoption theoretical models.

While UTAUT has limitations, it was the most appropriate among others presented in Table 1. Future research can expand this.

Table 1. Summary of relevant IT theoretical models.

Theory/model	Main dependent factors	Main independent factors	Origin	Originating area	Introduced
Theory of Reasoned Action (TRA)	Behavioral Intention, Behavior	Attitude toward behavior, subjective norm		Social psychology	Fishbein and Ajzen [1975]
Technology Acceptance Model (TAM)	Behavioral Intention to Use, System Usage	Perceived usefulness, perceived ease of use	adopted from TRA	Information Systems	Davis [1989]
Theory of Planned Behavior (TPB)	Behavioral Intention, Behavior	Attitude toward behavior, subjective norm, perceived behavioral control	derivation of TRA	Social psychology	Ajzen [1991]
Unified Theory of Acceptance and Use of Technology (UTAUT)	Behavioral intention, Usage Behavior	Performance expectancy, effort expectancy, social influence, facilitating conditions	Adopted from: TRA, TAM, TPB, Motivational Model (MM), Model of PC Utilization (MPCU) IDT and Social Cognitive Theory (SCT).	Information Systems	Venkatesh *et al.* [2003]
Task-technology Fit (TTF)	Performance	Task characteristics, technology characteristics, task technology fit, utilization.		Information Systems	Goodhue and Thompson [1995]

3.2. *Identification of adoption factors*

Increasing research on the adoption and use of Smartphone technology indicates the importance of studying and understanding adoption and use of Smartphone technology among scholars in various fields. A comprehensive literature review was conducted to review factors considered by the prior research. Based on the research reviewed in this paper, a taxonomy has been developed that includes the research topic, theory or model used, and variables identified in the research [Aldhaban *et al.* (2015)].

According to Sekaran [2003], identifying factors that were determined as important in previous research accompanied with rational relationships and connections that can be logically conceptualized form the basis of a theoretical research framework or model. A taxonomy of factors related to the adoption and use of Smartphone technology has been developed which classifies related factors under five main factors/variables as shown in Table 2 [Aldhaban *et al.* (2015)].

There are a number of methods that have been used to help researchers evaluate, validate, and select the most important factors out of a list of factors. In addition to the literature review, the research employed a number of qualitative methods namely: brainstorming, a focus group, and individual interviews as summarized in Table 3 [Finch and West (1997); Hurley *et al.* (1997); Williams *et al.* (2012); Ritchie *et al.* (2013); Seneler *et al.* (2008); Gale *et al.* (2013); McKenna *et al.* (2001); Meyer and Booker (2001)].

There were a total of 33 participants; 6 participants in the brainstorming session, 7 participants in the focus group session, and 20 participants in the individual face-to-face interviews. Eight factors were selected by at least two-thirds (22) of the participants.

Table 4 shows the results of the qualitative methods, showing each participant selection in each method of the three qualitative methods conducted. There were a total of 33 participants; 6 participants in the brainstorming session, 7 participants in the focus group session, and 20 participants in the individual face-to-face interviews. Eight factors that were selected by at least two-thirds (22) of the participants in the qualitative methods have been included in the research model: Performance expectancy, effort expectancy, social influence, brand influence, economic factors, facilitating conditions, perceived enjoyment, and design. After obtaining the results of the qualitative methods mentioned above, the research theoretical model was modified accordingly.

3.3. *Theoretical model*

The theoretical research model for this research (as shown in Fig. 1) is developed based on modification of the UTAUT model.

B1: Performance expectancy construct: Defined as "the degree to which an individual believes that using an information system will help him or her to attain benefits in job performance" [Venkatesh *et al.* (2003)]. The Smartphone provides users with many features and benefits that can help to improve their overall performance. Choudrie *et al.* [2014] studied the adoption and use of the Smartphone by older adults in the United Kingdom. Their finding showed that the performance

Table 2. Factors related to the adoption and use of Smartphone technology.

Main constructs	Attributes integrated into UTAUT from previous models	Factors related to adoption and user of smartphone that were identified in previous research
Technology characteristics & performance	— Perceived Usefulness [Chen *et al.* (2009); Ho *et al.* (2011); Kang *et al.* (2011); Koenig-Lewis *et al.* (2010); Shin (2007); Song and Han (2009); Venkatesh *et al.* (2003)] — Job Relevancies [Kim and Garrison (2009); Shin (2007)]. — Relative advantage [Mallat (2007)].	Perceived Ubiquity [Kim and Garrison (2009)]. Perceived Reachability [Kim and Garrison (2009)]. Mobility [Kargin *et al.* (2009)]. Accuracy. Controllability [Mallat (2007)]. Security [Mallat (2007)]. Perceived Availability [Shin (2007); Ho *et al.* (2011)]. Perceived Quality [Shin (2007)]. Content [Kargin *et al.* (2008, 2009)]. Screen Size [Kargin *et al.* (2008)]. Service Speeds [Kargin *et al.* (2009)]. Multimedia [Kang *et al.* (2011)]. Applications [Kang *et al.* (2011)]. Wireless Internet [Kang *et al.* (2011)]. Task [Chen *et al.* (2009); Park and Chen (2007); Zhou *et al.* (2010)].
Effort factors	— Ease of Use [Ho *et al.* (2011); Kang *et al.* (2011); Koenig-Lewis *et al.* (2010); Park and Chen (2007); Shin (2007)]. — Effort Expectancy [Mallat (2007)].	Simplicity [Kargin *et al.* (2008)]. Design [Kang *et al.* (2011)]. Complexity [Mallat (2007)].
Social influence factors		Self-efficacy [Park and Chen (2007)]. Social Norm [Verkasalo *et al.* (2010)]. Social Pressure [Shin (2007)].
Facilitating conditions	— Compatibility [Park and Chen (2007); Shin (2007)]. — Behavior Control [Verkasalo *et al.* (2010)].	Perceived Security [Mallat (2007)]. Environments [Chen *et al.* (2009); Park and Chen (2007)]. Organizational [Chen *et al.* (2009); Park and Chen (2007)]. Compatibility [Chen *et al.* (2009); Koenig-Lewis *et al.* (2010); Park and Chen (2007)]. Internal Environment [Shin (2007)]. External Environment [Shin (2007)]. Perceived Cost [Koenig-Lewis *et al.* (2010)]. Cost [Kargin *et al.* (2008)]. Perceived Cost Saving [Sang Hyun (2008)]. Perceived Fee [Kim *et al.* (2007)]. Company Willingness to Found [Sang Hyun (2008)].
Hedonic factors		Enjoyment [Kargin *et al.* (2009)]. Perceived Enjoyment [Shin (2007); Sun and Zhang (2008); Verkasalo *et al.* (2010)]. Fun [Chtourou and Souiden (2010)]. Entertainment Utility [Pan *et al.* (2013)].

Table 3.   Summary of research steps.

Research step	Number of participants	Description	Targeted participants
Literature Review		Extensive literature review conducted and taxonomy of factors related to the adoption and use of Smartphone developed.	
Brainstorming	6	A brainstorming session was conducted with experienced users of Smartphones and individuals, who have work experience in organizations and sectors related to Smartphone technology.	Experienced users of Smartphone and individuals, who have work experience in organizations and sectors related to Smartphones.
Focus Group	7	A focus group session was conducted with experienced users of Smartphones and individuals, who have work experience in organizations and sectors related to Smartphone technology.	Experienced users of Smartphone and individuals, who have work experience in organizations and sectors related to Smartphone technology.
Interviews	20	The interviews conducted were face-to-face, semi-structured, individual interviews. They were conducted with experienced users of the Smartphones and individuals, who have work experience in organizations and sectors related to Smartphone technology.	Experienced users of Smartphone and individuals, who have work experience in organizations and sectors related to Smartphones technology.

expectancy construct has the strongest influence on intention to adopt and use Smartphone technology [Choudrie *et al.* (2014)]. Therefore, the following hypothesis has been developed to test the relationship between the performance expectation construct and the users' intention to adopt and use Smartphone technology.

H1: *The performance expectancy construct will have a positive relationship with the users' behavioral intention to use the Smartphone technology.*

B2: Effort expectancy construct: Defined as "the degree of ease associated with the use of systems" [Venkatesh *et al.* (2003)], the effort expectancy construct reflects users' views or perceptions of the level or degree of ease of use or simplicity associated with the use of Smartphone technology. There are three factors that were identified in previous research that are associated with the level of effort expectancy when using the Smartphone and its related technologies namely simplicity [Kargin *et al.* (2008)], design [Kang *et al.* (2011)], and complexity [Mallat (2007)]. These factors were either directly associated with the effort expectancy construct or through other factors such as the ease of use factor [Ho *et al.* (2011); Kang *et al.* (2011); Koenig-Lewis *et al.* (2010); Park and Chen (2007); Shin (2007)]. Boontarig *et al.* [2012] studied the key factors that influence the intention of older adults to use the Smartphone for e-Health services in Thailand. Their finding includes that the effort expectancy factor has a significant influence on the intention of older adults in Thailand to use the Smartphone for e-health services [Boontarig *et al.* (2012)]. Choudrie *et al.* [2014], in their investigation of factors that influence adoption and

Table 4.   Factors selected by participants in the qualitative methods.

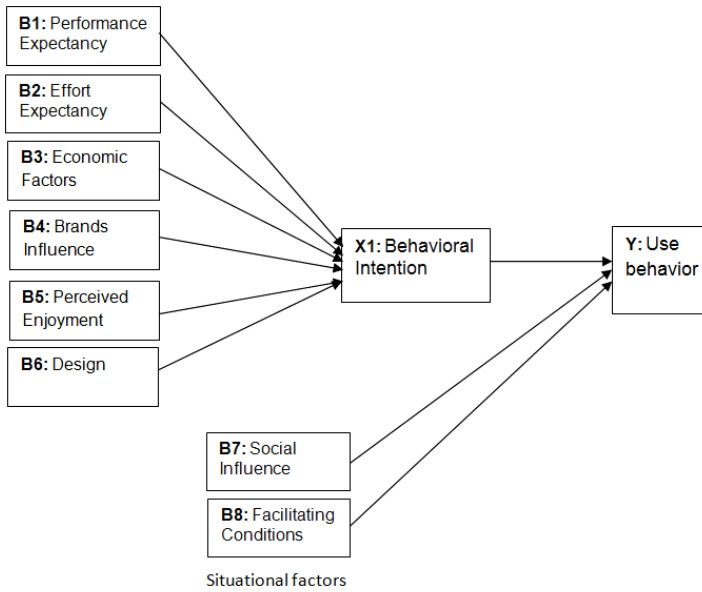| Factors	Participants in the individual interviews	Participants in the Brainstorming session	Participants in the focus group session	Total participants agreed
Performance Expectancy				31
Task Technology Fit				7
perceived Reachability				4
Mobility				10
Accuracy				6
Controllability				1
Security				7
Prceived availability				3
Perceived Quality				8
Content				9
screen size				9
Services Speeds				7
Design				22
Multimedia				4
Applications				10
Wireless Internet				4
Effort Expectancy				24
Simplicity				13
Social Influence				26
Facilitating Conditions				23
environments				3
Organizational				1
Compatibility				7
Economic Factors				24
Perceived Enjoyment				23
Fun				10
Entertainment Utility				8
After Services				3
Brand Influence				25
Perceived Convenience				7
Relaibility				18
Marketing (advertisement)				11
Operating System (OS)				9
Integration				2
Usability				10
Social Network				8
Experience				3
Type of screen				1
connectivity				2
Innovation				2

Fig. 1.   Theoretical research model.

use of Smartphone among older adults, found that effort expectancy construct has a significant influence on users' intention to adopt and use the Smartphone. Therefore, the following hypothesis has been created to test the relationship between the effort expectancy construct and users' intention to adopt and use the Smartphone technology.

H2: *The effort expectancy construct will have a positive relationship with the users' behavioral intention to adopt and use the Smartphone technology.*

B3: Economic factors construct: Individual users usually pay close attention to the price and cost of a technology before considering adopting and using that technology. Economic factors can be defined as the perceived value of the tradeoff between the perceived benefits of the technologies and the cost for acquiring and using it [Dodds *et al.* (1991); Venkatesh *et al.* (2012)]. Economic factors were identified as a construct that can predict users' behavioral intention to adopt and use new IT [Venkatesh *et al.* (2012)]. When the apparent benefits of acquiring and using a technology are perceived to be greater than the cost, the economic factors are expected to have a positive relationship with users' intention to adopt and use a technology [Venkatesh *et al.* (2012)].

The price of the Smartphone's devices and its services can be costly for some users, which can negatively influence their intention to adopt and use the Smartphone. If users perceive Smartphone technology as cost effective, they may be more willing to adopt and use it. In a number of empirical research studies related to the adoption and use of Smartphone technology, price or cost of the technology showed a significant relationship with users' intention to adopt and use it. Sang Hyun [2008] studied the factors that influence users to adopt and use mobile wireless technology

(MWT) via the Smartphone technology. In his results, perceived cost saving showed a positive relationship with users' behavioral intention to use the MWT via Smartphone.

Kim *et al.* [2007] also investigated factors that influence the adoption and use of the mobile internet. They found that the cost of mobile internet had a significant relationship with users' intention to adopt mobile technology [Kim *et al.* (2007)]. A number of factors related to economic factors, perceived cost [Koenig-Lewis *et al.* (2010)], perceived cost saving [Sang Hyun (2008)], and company willingness to fund [Sang Hyun (2008)] were determined as important factors that are associated with users' adoption and use of the Smartphone. Thus, the following hypothesis is created to test the relationship between the economic factors construct and users' intention to adopt and use the Smartphone technology.

H3: *The economic factors construct will have a positive relationship with the users' behavioral intention to adopt and use the Smartphone technology.*

B4: Brand influence construct: Studying the brand influence on the adoption and use of Smartphone technology was an approach that a number of scholars used in their research [Kim and Song (2009); Maloney (2009)]. Based on Ganesh and Kumar's work, Chris Maloney [2009] developed a framework to explore how learning effects influence the rate of adoption in the market, and to explain the impact of the learning effect on the adoption rate of the iPhone [Maloney (2009)]. Also, Kim and Song [2009] investigated the adoption and use of Blueberry Smartphone. They developed their own research model that investigated the social, economic, and technological characteristics that influence an individual's attitude toward the adoption of a specific Smartphone device, namely the Blueberry. Smartphone device brands such as Nokia, HTC, and Samsung have their own unique differences in their combination of hardware/software, and this may influence a user's acceptance and attitude toward the adoption of Smartphone differently. The iPhone was the most studied Smartphone device in articles reviewed [Arruda-Filho *et al.* (2010); Haywood and Boguslawski (2009); West and Mace (2010)]. Therefore, the following hypothesis has been developed to test the relationship between the brand influence construct and users' intention to adopt and use the Smartphone technology.

H4: *The brand influence construct will have a positive relationship with the users' behavioral intention to adopt and use the Smartphone technology.*

B5: Perceived enjoyment: Perceived enjoyment is defined as the extent to which the activity of using a specific system is perceived to be enjoyable in its own right, aside from any performance consequences resulting from system usage [Davis *et al.* (1992)]. Perceived enjoyment has been found to be a significant predictor of users' intention to adopt and use information technology [Hong *et al.* (2006); Je Ho and Myeong-Cheol (2005)]. Perceived enjoyment has become a key factor that is associated with an individual's intention to adopt and use technologies related to the Smartphone. In a number of previous research studies, scholars studied and explored the relationship between the perceived enjoyment construct and users' intention to adopt and use Smartphones and their related technologies. Their findings indicated that the

perceived enjoyment construct was found to be a positive and significant predictor of users' behavioral intention to adopt and use technology related to the Smartphone [Davis *et al.* (1992); Choudrie *et al.* (2014); Verkasalo *et al.* (2010)]. Therefore, the following hypothesis is created to test the relationship between the perceived enjoyment construct and users' intention to adopt and use the Smartphone technology.

H5: *The perceived enjoyment construct will have a positive relationship with users' behavioral intention to adopt and use the Smartphone technology.*

B6: Design: Aesthetic design of Smartphones has been studied to observe how it affects users' emotional reaction towards adoption of the Smartphone device [Nanda *et al.* (2008)]. In research focused on undergraduate and graduate students in Korea, Kang *et al.* [2011] analyzed the factors that may affect the adoption of the Smartphone. Their finding indicated that design factor has a positive relationship with perceived usefulness, which in turn has an effect on behavioral intention. Therefore, the following hypothesis is created to test the relationship between the design construct and users' intention to adopt and use the Smartphone technology.

H6: *The design construct will have a positive relationship with the users' behavioral intention to adopt and use the Smartphone technology.*

3.4. *Situational factors*

A consumer or user's situation can be viewed as comprising "of all those factors particular to a time and place of observation which do not follow from knowledge of personal (infra-individual) and stimulus (choice alternative) attributes and which have a demonstrable and systematic effect on current behavior" [Belk (1974)]. Clearer accounting for situational variables can greatly improve the researcher's ability to predict and understand consumers' actual behavior [Belk (1975)]. Ward and Robertson [1973] stated that "situational variables may account for considerably more variance than actor related variables." It was indicated that key situational variables have shown significant effects on behavior, and it is important to consider it with other related factors to obtain a better explanation of consumers' behavior [Belk (1975)]. Both individual and situational factors must be considered in order to explain a consumer's choices [Belk (1975)]. It was mentioned that both individual and situational factors must be accounted for to better explain users' actual use [Belk (1975)]. Actual behavior of buying or using a technology usually happens within a situational context, and that situation may act as a means to facilitate or to inhibit the occurrence of that actual behavior or it may not affect it at all [Harmon and Laird (2000)]. A number of scholars identified a number of general variables that can be characterized as situational factors including [Belk (1975); Ward and Robertson (1973); Harmon and Laird (2000)]:

- Physical surroundings
- Social influence or social surroundings such as other persons present, their characteristics, their apparent roles, and their interpersonal Interactions

- Time horizon
- Past experience

Alavi and Joachimsthaler [1992] mentioned user situational variables as one of the most relevant user factors that can help to determine the acceptance of technology. A number of situational factors are presented in the primary research model, namely facilitating condition and social influence. Two hypotheses are developed. "Key situational variables have been demonstrated to have significant effects on behavior."
Situational variables include the following:

- Users' task requirements
- Users' resource capability
- Users' experience with related products
- Organizational/social influences on users

B7: Social influence construct: Social influence is defined as "the extent to which a person perceives that important others believe he or she should use a new information system" [Venkatesh *et al.* (2003)]. Subjective norms and social influence have been recognized as important aspects that influence users' adoption of a new technology [Fishbein and Ajzen (1975)]. A number of factors, namely self-efficacy [Park and Chen (2007)], social norms [Verkasalo *et al.* (2010)], and social pressure [Shin (2007)] were determined in previous research as important factors that are related to social influence on users' adoption of and use of the Smartphone. Pan *et al.* [2013] studied the key factors that influence the adoption of the Smartphone among college students in China, and they indicated that social influence has a significant and positive influence on users' adoption of the Smartphone [Pan *et al.* (2013)]. Ling and Yuan [2012] empirically study the factors that influence users' adoption and use the Smartphone in China. They found that subjective norms were among the significant factors that have positive effects on users' adoption and use the Smartphone [Ling and Yuan (2012)]. Scholars pointed out the important role of cultural factors and its influence on the adoption and use of new information technologies [Al-Gahtani *et al.* (2007); Herbig and Palumbo (1994); Straub *et al.* (1997); Straub (1994); Van Everdingen and Waarts (2003)].

Saudi society has different cultural contexts in that it is characterized as a society that is more collectivist in nature in which individuals have closer ties and influential effects among them. Therefore, the following hypothesis is created to test the relationship between the social influence construct and users' intention to adopt and use the Smartphone technology.

H7: *The social influence construct will have a positive relationship with the use behavior construct.*

B8: Facilitating conditions construct: Defined as "the degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system" [Venkatesh *et al.* (2003)]. In Smartphone technology,

facilitating conditions can include connectivity and internet service availability, services support, usage information, system compatibility, individual financial resource, and more factors that facilitate better use of this technology. A number of factors that are related to facilitating conditions including perceived security [Mallat (2007)], environments [Chen *et al.* (2009); Park and Chen (2007)], organizational [Chen *et al.* (2009); Park and Chen (2007)], compatibility [Chen *et al.* (2009); Park and Chen (2007); Koenig-Lewis *et al.* (2010)], internal environment [Shin (2007)], and external environment [Shin (2007)] were determined in previous research as important factors that are associated with users' adoption and use of the Smartphone.

Boontarig *et al.* [2012] investigated the key factors that influence intention of older people in Thailand to use the Smartphone for e-Health services. They found that the facilitating conditions construct has a significant influence on this population's intention to use the Smartphone for e-Health services [Boontarig *et al.* (2012)]. In their study of factors that influence adoption and use of Smartphone among older adults, Choudrie *et al.* [2014] found that the facilitating conditions construct is an important factor that has a significant influence on users' intention to adopt and use the Smartphone. Therefore, the following hypothesis is created to test the relationship between the facilitating conditions construct and the use behavior.

H8: *Facilitating conditions construct will have a positive relationship with the use behavior regarding the Smartphone technology.*

X1: Behavioral Intention: The behavioral intention construct has been indicated to be a key predictor of use behavior or actual use of technology [Venkatesh *et al.* (2003)].

In a number of previous studies, researchers examined the relationship between the behavioral intention construct and the use behavior construct. They found the behavioral intention construct to be a strong and important predictor of use behavior (actual use) of Smartphones and their related technologies [Venkatesh *et al.* (2003); Kim (2008); Wu and Wang (2005)]. Use behavior or actual use of Smartphones is expected to be associated with users' behavioral intention. Therefore in this research, behavioral intention is expected to have a positive relationship with use behavior construct. Thus, the following hypothesis is created.

H9: *The behavioral intentions construct will have a positive relationship with the use behavior construct.*

4. Research Design and Rationale

To insure the quality and validity of the survey for this research, the survey instrument has been reviewed and validated. Content validation has been assessed by an expert panel in which experts were asked to provide their judgment and opinions about the survey items regarding two main aspects:

- The first aspect was how well each item represents the intention of the variable/ construct it intended to measure.

Table 5.   Developing and validating the English version of the survey instrument.

	Step	Description	Outcome
1	Developing the preliminary version based on previous related survey	The preliminary version of this survey questionnaire has been developed based on previous related surveys obtained from existing research	Version 1
2	Pre-validate (Read-aloud)	Using the read-aloud method, version one of the survey was administered to a group of Ph.D. students in the Department of Engineering and Technology Management to obtain their feed-back and comments.	Version 2
3	Pilot test 1	Version 2 of the survey was ad ministered to a group of graduate students at Portland State University to obtain their feedback and comments.	Version 3
4	Expert Panel 1	A validation tool was been developed, based on survey version 3, to obtain experts'judgment on the relevance of each question and the ease of answering each question. The expert panel was formed and the developed validation tool was administered to nine the experts in the panel.	Version 4
5	Pilot test 2	Version 4 of the survey was incorporated into a web-based survey and linked emails have been sent to a group of Smartphones users to obtain their comments and feedback.	Version 5

• The second aspect was how easy it was for the targeted participants to answer each survey item. A tool was developed to obtain experts' judgments regarding survey instrument content validation.

The validation process was conducted in two main phases, which included a number of steps to develop and validate the survey instrument as shown in Tables 5 and 6.

There are four main telecommunications companies in Saudi Arabia that provide mobile services, including Smartphone services. The four companies are Saudi Telecom Company (STC), Mobily, Zain Telecom, and Bravo Telecom. Each company has an equal chance of providing mobile services, including Smartphone technology, to all types of customers. Each company has its own main branches and sub-branches in all of the major regions of Saudi Arabia. Due to the time, cost, and effort needed to collect data, the author intends to limit the research sampling frame to 5000 Smartphones users, who have been randomly selected from one of these four Saudi telecommunications companies.

When using the structural equation modeling (SEM) method, it is recommended to obtain at least ten observations for each indicator (item) to set the lower boundary for an appropriate sample size [Chin and Newsted (1999)]. Another suggestion indicated that the minimum sample size can be indicated by the use of the ratio (r) of indicators to the latent variables, where $r = P/K$; P is the indicator variables and the K is the latent variables [Boomsma (1982)]. Based on this ratio suggestion, if $r = 3$ it would require a sample size of at least 200 cases, and if $r = 2$ it would require a sample size of at least 400 cases [Ding *et al.* (1995)]. For setting the lower boundary of sample size in a medium complexity SEM model, it was suggested

Table 6.   Developing and validating the Arabic version of the survey instrument.

	Step	Description	Result
1	Translating the survey from English into Arabic	Version 5 of the survey was translated from English into Arabic	Version 6
2	Pre-validate (Read-aloud)	A read-aloud session was conducted. Version 6 of the survey was administered to a group of PSU students who are smartphone users and speak Arabic	Version 7
3	Expert panel 2	A validation tool was developed, based on survey version 7, to obtain experts' judgment on the translation of the survey questions from English into Arabic. An expert panel was developed and the validation tool was administered to an expert panel of 7 members.	Version 8
4	Translate the Arabic Version back into English	Version 7 of the survey has been translated from Arabic back into English	Version 9
5	Expert panel 2	Version 8 of the survey has been administered to an expert panel of 7 members to validate the translation back to English to insure that the meaning of questions did not change.	Version 10
6	Pilot test 3	Version 9 of the survey was incorporated into a web-based survey and linked emails were sent to a group of Smartphones' users, (Arabic speakers) to test the survey and obtain their comments and feedback.	Version 11

to obtain at least 200 cases [Mulaik *et al.* (1989)]. Hair *et al.* [2010] suggested that when using SEM to analyze a model with seven or less constructs, that the construction of a minimum sample size of 300 cases is required. For a model with a larger number of constructs and with fewer than three measured items, a minimum sample size of 500 cases is required.

Iacobucci [2010] studied the effect of increasing the sample size on fit indices, such as the comparative fit index (CFI), by using sample sizes as small as 30 cases and as large as 500–1000 cases. The results indicated that the effect is non-linear, which suggests that increasing the sample size will have minimal effects on CFI. When using SEM to analyze data, sample size can be associated with a number of critical aspects that should be considered to gain more robust results, such as obtaining reliable factors that each have three or more indicators to gain sufficient convergence, and a proper solution with even a smaller sample size such as 150 cases [Anderson and Gerbing (1984)]. When using SEM, its factors and indicators will be measured and validated. This should obtain an acceptable model fit to continue onto the next step of testing the path relationships in the structural model.

The plan for setting the minimum effective sample size for this research based on the above suggestions when using SEM will be as follows: The initial research model for this research consists of eight factors or variables. The researcher intends to have at least three to four indicators for each factor which could total around 27 items or

Table 7. Example of scenarios to estimate the minimum sample size required for this research.

Number of possible variables in the model	Expected number of indicator (P)	Maximum sample size (lower bound) (P × 10)	Expected response rate	N
8	27	216	8%	2700
8	30	240	8%	3000
8	27	216	20%	1080
8	30	240	20%	1200

indicators. Following the suggestion to have at least 10 observations for each indicator makes the minimum sample size equal 270 cases. When using the ratio method that was suggested above, 27 indicators divided by 8 variables will generate 3.3 that is in the category of a ratio $r = 3$, which indicates a minimum size of at least 200 cases. Since the SEM minimum sample size is based on the number of variables and predictors in the model, based on the response rate for web-based surveys, the minimum or lower bound of the sample size will follow the scenarios in Table 7.

After the design for the web-based survey f was finalized and activated, an invitation email with an electronic link to the web survey was set to a randomly selected 5000 possible participants. Out of the 5000 requests sent out, a total of 657 responses were returned, giving an overall response rate of 13.14% (657/5000). After data screening and elimination of invalid responses, 641 responses were analyzed (12.8%). When using SEM, it is recommended to obtain at least ten data points for each item. The survey questionnaire for this research was designed based on the developed research model and it included a total of 34 items. The minimum suggested sample size for this model would be 340 data points and the total final responses usable in this research were 641 (12.8%). It has been indicated that a typical research survey often obtains no more than a 5–10% response rate [Alreck and Settle (1994)] so 12.8% is satisfactory. Therefore, the response rate in this research of 12.8% is well within the expected and acceptable range.

ANOVA was used as the preferred statistical analysis method to investigate the possibility of non-response bias occurrence. Based on the ANOVA analysis, there was no statistically significant difference between respondents among the three waves of data collection (initial survey and the two follow-ups). The mean of measurement items from respondents in the initial survey and the two follow ups have been compared at ($p < 0.05$) for five important variables measured in this survey: Performance Expectancy (PE) Item (PE1), Expected Effort (EE) Item (EE1), Social Influence (SI) Item (SI1), Brand Influence (BIF) Item (BIF1), and Economic Factors (EF) Item (EF1).

All factors in the research model are specified as reflective since their indicators are highly correlated and largely interchangeable as shown in Table 7 [Jarvis *et al.* (2003)]. To assess the reliability of the survey instrument used, Cronbach's alpha measurement was conducted to test the internal consistency for each construct. Scholars indicated that increasing the value of Cronbach's alpha is partially based upon the number of items; the more items the higher the value. Cronbach's alpha of 0.7 is considered to be a good and an acceptable level of reliability. However, the

Table 8.   Reliability of constructs and its specification.

Factor name	Factor code	Number of items	Cronbach's alpha	Specification
Performance Expectancy	PE	4	0.803	Reflective
Effort Expectancy	EE	3	0.870	Reflective
Brand Influence	BIF	3	0.803	Reflective
Economic Factors	EF	4	0.734	Reflective
Perceived Enjoyment	PJ	4	0.853	Reflective
Design	DS	3	0.727	Reflective
Facilitating Conditions	FC	4	0.748	Reflective
Social Influence	SI	3	0.601	Reflective
Behavioral Intentions	Bl	3	0.862	Reflective
Use Behavior	UB	3	0.646	Reflective

recommended minimum Cronbach's alpha is 0.6. The results of Cronbach's alpha showed that all constructs in this research have achieved Cronbach's alpha values above the recommended value of 0.6 as shown in Table 8.

Data collected for this research have been screened and organized as detailed in the previous chapter using a number of methods and software applications such as SPSS and Microsoft Excel. SEM has been utilized in this research which included two main steps: (1) Conducting confirmatory factor analysis (CFA) to verify the measurement of the research model and obtain an acceptable and adequate model fit; and (2) Transferring the acceptable model into a full structural model to analyze the hypothesized relationships among constructs in the proposed research model. In the measurement model, CFA enabled the researcher to examine if the hypothesized relationships between the observed and latent variables do indeed exist.

The main task in the measurement mode phase is to test the model and verify the goodness-of-fit between the data collected and the hypothesized model. CFA examined the relationship between latent variables and their observed measures. A theoretical basis and a number of qualitative methods have been utilized to develop the research model to be tested using CFA. It has been used to validate the measurement model to obtain an acceptable and adequate model fit necessary to proceed to next step the structural model. Measurement model using CFA using SPSS package and AMOS software was conducted. Based on recommended indices, the first model measurement has shown an acceptable fit in a number of recommended indices. However, a number of indices showed lower score than recommended. To improve model measurement and obtain an acceptable model fit actions had to be taken. A number of error terms that showed a high covariance within their own construct namely e33 and e31 were correlated and e18 and e17 were correlated. Moreover a number of items that showed a low loading namely SI3 and EF1 were removed [Hooper *et al.* (2008)]. After making the recommended changes, the model was run again and it showed a better model fit with better indices scores as shown in Table 9.

The final results of the SEM: full structural model is shown in Fig. 2.

Table 9. Model fit indices: results of the model measurement fit.

Model fit indices	GFI	AGFI	NFI	CFI	RMSEA	χ^2/d.f
Recommended Value	> 0.9	> 0.8	> 0.9	> 0.9	< 0.05	< 3
Obtained Value (First Model fit)	0.896	0.871	0.885	0.927	0.049	2.5
Obtained Value (Final Model fit)	0.911	0.892	0.907	0.946	0.044	2.2
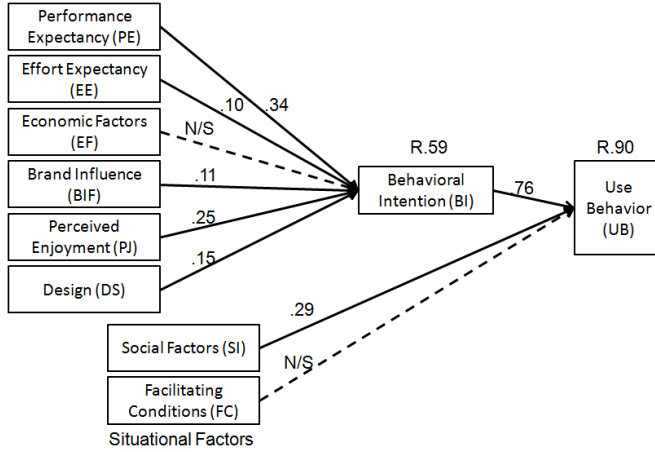
Fig. 2. The results.

5. Hypothesis Testing Results and Discussion

H1: *The performance expectancy construct will have a positive relationship with the users' behavioral intention to use the Smartphone technology.*

The analysis results show a significant and positive relationship between performance expectancy construct and users' behavioral intentions to adopt and use the Smartphone technology in Saudi Arabia. Based on the findings in this research, performance expectancy has the strongest positive relationship with users' behavioral intention to adopt and use the Smartphone in Saudi Arabia. The results imply that Smartphones services providers, device providers, manufacturers, and other stakeholders may increase potential consumers' intention to adopt and use Smartphones by focusing on aspects that contribute to enhancing and improving performance of them. The results indicated Smartphone users in Saudi Arabia think that the performance of a Smartphone is significantly important to them and performance attributes can increase their adoption and use of these phones. This finding is consistent with results in a number of related previous studies [Choudrie *et al.* (2014); Gao *et al.* (2015)]. Based on the analysis results and consistent with previous finding in related literature, a conclusion can be drawn that performance of Smartphones can be an important, positive, and significant determinant of users' intention to adopt and use Smartphones in Saudi Arabia.

H2: *The effort expectancy construct will have a positive relationship with the users' behavioral intention to adopt and use the Smartphone technology.*

The analysis results show a significant and positive relationship between effort expectancy construct and users' behavioral intentions to adopt and use the Smartphone technology in Saudi Arabia. The findings suggest that enhancing and improving users' intention to adopt and use the Smartphone is positively associated with the improvement of effort expectancy of this technology and that, Smartphone services providers, device providers, and manufacturers as well as other stakeholders may increase potential consumers' intention to adopt and use the Smartphone by focusing on aspects that contribute to effort expectancy construct such as improving simplicity and ease of using the device. This result indicates that improving the level of effort expectancy is positively associated with improving the users' intention to adopt and use the Smartphone. This finding is consistent with results in a number of related previous studies such as Ho *et al.* [2011], Shin [2007], and Choudrie *et al.* [2014]. Based on the analysis results and consistent with previous findings in related literature, a conclusion can be drawn that efforts associated with improving use of Smartphones can be important, positive and significant determinants of users' intention to adopt and use this technology in Saudi Arabia.

H3: *The economic factors construct will have a positive relationship with the users' behavioral intention to adopt and use the Smartphone technology.*

The analysis conducted did not show a significant relationship between the economic factors construct and the behavioral intention construct. In contrast to previous research factors, construct has no significant relationship with users' intention to adopt and use Smartphone technology in Saudi Arabia. These results imply, to some extent, the general feeling by users of Smartphones in Saudi Arabia that the price of these devices and services are reasonable compared to the economic value they offer. Contrary to popular belief in mobile and Smartphone literature, economic factors such as cost and pricing seem to have no association with users' intention to adopt and use these technologies in Saudi Arabia. This is conflicting with prior research [Dodds *et al.* (1991); Venkatesh *et al.* (2012)]. This may be attributed to the high competition among Smartphones device manufacturers and providers to provide better and cheaper Smartphones devices and services. Moreover, it may be attributed generally to the strong and growing economy in Saudi Arabia at the time of conducting this research that contributes to improving users' ability to consider Smartphone devices and services as reasonable and very affordable technology for them. Based on analysis and results a conclusion can be drawn that economic factors related to Smartphones are not a significant determinant of users' intention to adopt and use them in Saudi Arabia.

H4: *The brand influence construct will have a positive relationship with the users' behavioral intention to adopt and use the Smartphone technology.*

The analysis shows a significant and positive relationship between brand influence construct and the users' behavioral intention construct. The results indicate that the users' intention to adopt and use Smartphone technology in Saudi Arabia is significantly and positively associated with the users' perception of the brand, which is

in line with prior research [Kim and Song (2009); Maloney (2009)]. The findings suggest that enhancing and improving users' perception of a Smartphone's brand could positively attribute to their intention to adopt and use these devices. Moreover, the results imply that Smartphones' service providers, device manufactures, and other stakeholders may increase potential consumers' intention to adopt and use this technology by focusing on aspects that contribute to brand influence.

The Apple iPhone could be an example of how brand influence is positively associated with users' intention to adopt and use Smartphones. Loyal iPhone users have adopted the Apple iPhone because they have a positive perception of Apple; they are more excited to see the next generation of the iPhone; and they are willing to wait in line and pay more money to get it because it's the Apple brand. Working to improve the brand image of a Smartphone such Apple can positively attribute to users' intention to adopt and use Smartphones, especially in Saudi Arabia. Based on the analysis results and consistent with previous finding in related literature, a conclusion can be reached that the brand of a Smartphone can be a positive and significant predictor of users' intentions to adopt and use these devices in Saudi Arabia.

H5: *The perceived enjoyment construct will have a positive relationship with users' behavioral intention to adopt and use the Smartphone technology.*

The analysis results show a significant and positive relationship between perceived enjoyment construct and users' behavioral intention construct. The results indicate that users' intention to adopt and use Smartphone technology in Saudi Arabia is significantly and positively associated with the users' perceived enjoyment of the device. The finding suggests that enhancing and improving users' perceived enjoyment of a Smartphone could positively attribute to the intention to adopt and use Smartphones.

Moreover, the results imply that Smartphones services providers, device manufacturers, and other stakeholders may increase potential consumers' intention to adopt and use Smartphones by focusing on improving aspects that contribute to users' enjoyment of these devices. The finding of this analysis is aligned with the results in a number of previous studies [Davis *et al.* (1992); Choudrie *et al.* (2014); Verkasalo *et al.* (2010)]. Based on findings, and consistent with previous findings in related literature, a conclusion can be reached that perceived enjoyment of Smartphones can be an important, positive, and significant determinant of users' intention to adopt and use Smartphones in Saudi Arabia.

H6: *The design construct will have a positive relationship with the users' behavioral intention to adopt and use the Smartphone technology.*

The analysis results show a significant and positive relationship between design construct and users' behavioral intention construct. The findings indicate that users' intention to adopt and use Smartphone technology in Saudi Arabia is significantly and positively associated with the design of the Smartphone, and that enhancing and

improving the design of a Smartphone could positively attribute to users' intention to adopt and use Smartphones, especially in Saudi Arabia.

Moreover, the results imply that Smartphone device providers and manufacturers may increase potential consumers' intention to adopt and use Smartphones by focusing on aspects that contribute to the design of the devices. This finding, to some extent, is consistent with the results in a number of previous studies [Nanda *et al.* (2008); Kang *et al.* (2011)], which indicated that design can positively and significantly contribute to users' adoption and use of this technology. Based on findings and consistent with previous results in related literature, a conclusion can be drawn that the design of a Smartphone can be an important, positive and significant determinant of users' intention to adopt and use Smartphones in Saudi Arabia.

H7: *The Social Influence construct will have a positive relationship with the usage behavior construct.*

The analysis results show a significant and positive relationship between the social influence construct and the use behavior construct. The results indicate that users' use behavior regarding Smartphone technology in Saudi Arabia is significantly and positively associated with the social influence construct. The findings further suggest that the surrounding social influence could positively attribute to users' use behavior of Smartphones.

Moreover, the results imply that Smartphones service providers and manufacturers may increase potential consumers' use behavior in using the technology by paying more attention to the social influences in a region and focusing on aspects that contribute to social influence in that region. This finding is aligned with the results in a number of previous studies in which social influence showed a positive and significant relationship with use of Smartphones and its related technologies as mentioned above. Based on that, and consistent with previous findings in related literature [Al-Gahtani *et al.* (2007); Herbig and Palumbo (1994); Straub *et al.* (1997); Straub (1994); Van Everdingen and Waarts (2003)], a conclusion can be drawn that social influence can be an important, positive, and significant determinant of users' actual use of Smartphones in Saudi Arabia.

H8: *The Facilitating conditions construct will have a positive relationship with the use behavior.*

The analysis conducted did not show a significant relationship between the facilitating conditions construct and the use behavior construct. In contrast to related previous research, the facilitating conditions construct has no significant relationship with actual use of Smartphones in Saudi Arabia. This result could imply, to some extent, a general feeling among users of Smartphones in Saudi Arabia that service support, usage information, system compatibility, individual financial resources, and experience are widely available and satisfied.

This is contrary to multiple findings in research [Venkatesh *et al.* (2003)] related to mobile and Smartphones, facilitating conditions related factors [Mallat (2007); Chen *et al.* (2009); Park and Chen (2007)], such as services support, usage

information, system compatibility, individual financial resources, and experience seems not to induce significant association with users' actual use of Smartphones in Saudi Arabia. That can be attributed to the wide availability of technical supports, reliable infrastructure, and users' knowledge and experiences of the actual use of this technology in Saudi Arabia. Moreover, this could be attributed to the hard work by services providers and device manufacturers to provide Smartphones users with the needed technical supports, reliable infrastructure, and better knowledge and experiences driven by high competition telecommunications companies in Saudi Arabia and the Smartphones devise manufacturers worldwide.

H9: *The behavioral intentions construct will have a positive relationship with the use behavior construct.*

The analysis results show a significant and positive relationship between perceived behavioral intentions and the use behavior construct. The results indicate that use behavior or actual usage of Smartphone technology in Saudi Arabia is significantly and positively associated with the users' behavioral intentions to adopt and use the Smartphone. The findings suggest that enhancing and improving users' use behavior or actual usage of Smartphones could positively attribute to improving and enhancing their behavioral intention to adopt and use the technology.

Moreover, the results imply that services providers, device manufacturers, and other stakeholders may increase potential actual usage of Smartphones by focusing on aspects that contribute to users' behavioral intentions to adopt and use Smartphones. A number of factors such as performance expectancy, effort expectancy, brand influence, perceived enjoyment, and design have a positive indirect relationship with users' actual use of Smartphones through users' behavioral intention factor. This finding corresponds with the results of a number of previous studies [Venkatesh *et al.* (2003); Kim (2008); Wu and Wang (2005)], which indicated that users' behavioral intention is an important determinant of actual use. Based on analysis results and consistent with previous findings in related literature, a conclusion can be drawn that users' behavioral intentions can be an important, positive and significant determinant of users' actual use of Smartphones in Saudi Arabia.

Table 10 provides a summary of the hypothesis testing results.

Table 10. Hypotheses testing results — standardized regression weights.

Factor	Relationship	Factor	Estimate	*p*-Value	Label
Behavioral Intention	←	Performance Expectancy	0.339	0.000	Supported
Behavioral Intention	←	Effort Expectancy	0.102	0.009	Supported
Behavioral Intention	←	Economic Factors	0.051	0.302	Not supported
Behavioral Intention	←	Brand Influence	0.106	0.014	Supported
Behavioral Intention	←	Perceived Enjoyment	0.249	0.000	Supported
Behavioral Intention	←	Esign	0.153	0.002	Supported
Use Behavior	←	Behavioral Intention	0.762	0.000	Supported
Use Behavior	←	Social Influence	0.291	0.000	Supported
Use Behavior	←	Facilitating Conditions	−0.018	0.429	Not supported

The theoretical implications of this study can be seen through the similarities and differences between prior studies and this study:

- In consistent with previous research, the results imply that:

  – Many Smartphones users in Saudi Arabia are influenced mostly by the expected performance of their devices, and the benefits and gains that they may attain in their daily life from adopting and using Smartphones.
  – Many Smartphones users in Saudi Arabia are influenced by their peers, close friends, and other figures in their society in their use behavior of Smartphones, and they are more likely to follow the social norm in their society.
  – More Smartphones users in Saudi Arabia are looking for more hedonic features and entertainment options in their devices.
  – More Smartphones users in Saudi Arabia believe that the appearance, color, the overall look, and feel of the devices are important to them, and they pay attention to the brand names of Smartphones.

- In contrary with previous research, the results imply that:

  – Many Smartphones users in Saudi Arabia believe that the cost and pricing of Smartphones are reasonable and acceptable for them.
  – Many Smartphones users in Saudi Arabia may have more experiences and knowledge with use of the device and its related technologies.

The practical implications can be summarized as following. "The Communication and Information Technology Commission (CITC) has adopted a cooperative strategy between the related parties (government agencies, media players, telecom operators, and educational bodies in the country) to leverage the broadband based economy, mainly the e-commerce" [T.C.A.I.T.C. (2014); Al-Hudhaif and Alku-beyyer (2011)]. The finding showed that the social influence factor showed a positive and significant relationship with the actual use of Smartphones in Saudi Arabia. Therefore, providing incentives and encouragement to groups' leaders, celebrities, society leaders, and other figures could facilitate, drive, and encourage the use of Smartphones to obtain services and products by government agencies. This research has comprehensively studied the general users of Smartphone technology to provide more insight into the key factors that are associated with users' intention to adopt and use the Smartphone in Saudi Arabia. The empirical results of this research provide beneficial information to both researchers and practitioners in the IT domain. Furthermore, the outcome of this research provides stakeholders with valuable insight and precise information that is based on data obtained from general Smartphones users in Saudi Arabia. Those insights and information can greatly assist in improving the adoption and use of Smartphone technology, enhancing users' experiences, improving products, services, and their related markets, especially in Saudi Arabia. This empirical research is expected to show the importance and benefits of utilizing and modifying theoretical model to better understand users' intention to adopt and use the Smartphone. Furthermore, this research has empirically demonstrated the use of the literature review, a number of qualitative

methods, and the modification of the IT theoretical model UTAUT to study, test and analyze users' adoption and use of new IT such as the Smartphone technology in emerging regions such as Saudi Arabia. A number of market researchers indicated that the capabilities of Smartphones provide marketers with a substantial possibility to reach and better serve their consumers [Persaud and Azhar (2012)]. Also, they indicated that the more the price of the Smartphone and its services decrease, the more users will most likely increase their online usage [Persaud and Azhar (2012)]. This provides a huge opportunity to expand their marketing strategy with mobile marketing strategy. The finding showed that the price of Smartphones and their service seems to be reasonable and acceptable to many users in Saudi Arabia, and this can be used by marketers to align and expand their strategies accordingly. Telecommunication companies in Saudi Arabia are facing a sharp decline in their revenues for the year 2015 [Alfaifi (2015)]. Dr. Ahmed Sindi, an expert in Communications and Information Technology, linked the decline in revenue to several causes, including the lack of effective actions to reach their customers and the lack of understandings their needs and preferences in a timely manner [Alfaifi (2015)]. The results provide useful insights and information that can be used by telecommunication companies in Saudi Arabia to better understand their customers and to develop their strategies accordingly. A trend noticed is that many Smartphones users are starting to shift to the use of Smartphones for computing more than using laptops [Page (2013)]. Also, it was indicated that there is a lack of more innovative soft keyboard options in Smartphones [Page (2013)]. The results in this paper show that performance expectancy is a key factor that has a positive and significant relationship with users' intention to adopt and use Smartphones in Saudi Arabia. The results imply that more people will adopt and use Smartphones if the phone could help them to attain more benefits in their daily life, enable them to accomplish tasks more quickly, and to improve their performance in many of their daily activities. Based on those results, practitioners could modify and align their strategy and policy to focus more on developing and building Smartphones that could satisfy users' preferences and needs.

6. Conclusions

This research developed a model based on literature review, existing related theoretical models, and the use of a number of qualitative methods to obtain experts' opinions. The developed research model was utilized, using the data collected to explore the key factors that are associated with users' adoption and use of Smartphones in emerging regions, specifically in the case of Saudi Arabia.

The findings in this paper showed that Smartphones users in Saudi Arabia rely mainly on their perceptions of performance expected of the device to make decisions to adopt and use this type of technology. Therefore, the implications for related practitioners are to improve the expected performance and the expected benefits or gains of adopting and use of Smartphones to encourage and increase more favorable intentions among potential users to adopt and use the technology. Moreover, the results imply that more people will adopt and use Smartphones in Saudi Arabia if

they became more useful to them in their daily lives, enabling them to accomplish tasks more quickly, and increasing their overall productivity. Brand name influence was found to be a one of the factors that could encourage and increase users' intention to adopt and use Smartphones; therefore, it is recommended to enhance brand name and increase users' loyalty to their brand name. Perceived enjoyment was found to be one of the key factors that could increase users' intention to adopt and use Smartphones; therefore, it is recommended that the device be made more enjoyable to users. Design of the Smartphones was found to be one of the factors that could increase users' intention to adopt and use the technology; therefore, it is recommended that the design of Smartphones be enhanced to appeal to more users.

As mentioned earlier [Hall and Anderson (2009); West and Mace (2010); Butler (2011)], Smartphones manufacturers and providers change their strategies and policies in order to obtain a better market share. For example; Apple had a policy that made its IPhone available exclusively through AT&T. The company decided to change its strategies and sell their product to more companies to increase its market share. The results of this research provide a useful insight that can be used by practitioners in building and developing a better strategies and policies based on users' points of view. The research model was developed to explore and study key factors that may have relationships with users' adoption and use of Smartphone technology in Saudi Arabia using a comprehensive and holistic approach.

This research did not look at other mediating factors that may modify the relationships between the factors in the research model. The researcher is considering future research that reviews, evaluates, and includes possible mediating factors and explores the influence of these mediating factors. This research collected data from Smartphone users in Saudi Arabia at one point in time. The economy of Saudi Arabia at that time was very strong and people were eager to spend and explore newer and better technology. The results of this study showed that economic factors did not show a significant relationship with users' behavioral intention to adopt and use Smartphones. The economic factors could change dramatically from any change in the Saudi Arabian economy, which could change the significance of the results found in this research. This paper explored the key factors that may have relationships with users' adoption and use of Smartphones in a comprehensive and holistic way. Based on the results of this research, future research can focus more on the specific factors that have significant relationships. Each of these key factors has a number of sub-factors which may have different contributes. Based on the results of this research, further research can be conducted that can focus on the sub-factors and investigate their relationships and influence. This research collected data from general Smartphones users in Saudi Arabia, and did not focus on early adaptors of this technology. Early adopters may have a different view of Smartphones that could be targeted and investigated in future research.

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References

Adams, J., King, C., Pendlebury, D., Hook, D., Wilsdon, J. and Zewail, A. (2011). *Global Research Report, the Middle East, Exploring the Changing Landscape of Arabian, Persian and Turkish Research*. Thomson Reuters: Leeds, pp. 25–27.

Ajzen, I. (1991). The theory of planned behavior, *Organizational Behavior and Human Decision Processes*, **50**: 179–211.

Alakloby, O. M. (2012). Dermatology research in Saudi Arabia: Challenges and hopes. *Journal of the Saudi Society of Dermatology & Dermatologic Surgery*, **16**: 53–55.

Alamri, M. (2011). Higher education in Saudi Arabia. *Journal of Higher Education Theory & Practice*, **11**: 88–91.

Alavi, M. and Joachimsthaler, E. A. (1992). Revisiting DSS implementation research: A meta-analysis of the literature and suggestions for researchers. *Mis Quarterly*, **16**: 95–116.

Alawi *et al.* (2012). Saudi Telecom Sector. Available at: http://www.aljaziracapital.com.sa/report_file/ess/SEC-32.pdf.

Al-Darrab, I. A., Gulzar, W. A. and Ali, K. S. (2013). Status of implementation of safety, quality and environmental management systems in Saudi Arabian industries. *Total Quality Management & Business Excellence*, **24**: 336–354.

Aldhaban, F., Daim, T. U. and Harmon, R. (2015). Exploring the adoption and use of the smartphone technology in emerging regions: A literature review and hypotheses development. In *2015 Portland International Conference on Management of Engineering and Technology (PICMET)*, Portland, Oregon, USA, pp. 2355–2370.

Alfaifi, A. (2015). *Ghost Pressures Prosecuted Telecommunications Companies*. Available at: http://www.alwatan.com.sa/Economy/News_Detail.aspx?ArticleID=240656& CategoryID=2.

Al-Fakhri, M. O., Cropf, R. A., Kelly, P. and Higgs, G. (2008). E-government in Saudi Arabia: Between promise and reality. *International Journal of Electronic Government Research (IJEGR)*, **4**: 59–85.

AlGhamdi, R., Drew, S. and Alkhalaf, S. (2012). Government initiatives: The missing key for e-commerce growth in KSA. arXiv:1211.2398.

Al-Gahtani, S. S., Hubona, G. S. and Wang, J. (2007). Information technology (IT) in Saudi Arabia: Culture and the acceptance and use of IT. *Information & Management*, **44**: 681–691.

Al-Ghaith, W. A., Sanzogni, L. and Sandhu, K. (2010). Factors influencing the adoption and usage of online services in Saudi Arabia. *The Electronic Journal of Information Systems in Developing Countries*, **40**: 1–32.

Al-Hudhaif, S. A. and Alkubeyyer, A. (2011). E-commerce adoption factors in Saudi Arabia. *International Journal of Business and Management*, **6**: 122.

Alkhathlan, K. A. (2013). Contribution of oil in economic growth of Saudi Arabia. *Applied Economics Letters*, **20**: 343–348.

Al-Meshal, S. A. and Almotairi, M. A. (2013). Consumer acceptance of mobile marketing: An empirical study on the Saudi Female. *International Journal of Marketing Studies*, **5**: 94.

Alnajjar, G., Mahmuddin, M. and Ramayah, T. (2013). Adoption factors of m-commerce in Jordan: From personal and societal norms perspectives. *International Journal of Computer Theory and Engineering*, **5**: 155.

Alreck, P. L. and Settle, R. B. (1994). *The Survey Research Handbook*. McGraw-Hill, New York.

Alsenaidy, A. and Tauseef, A. (2012). A review of current state M Government in Saudi Arabia. *Global Engineers & Technologists Review*, **2**: 5–8.

Alwagait, E. (2013). Popularity analysis for Saudi telecom companies based on twitter data. *Research Journal of Applied Sciences, Engineering and Technology*, **6**: 4676–4680.

Alwahaishi, S. and Snášel, V. (2013). Factors influencing the consumer' adoption of mobile internet. In *The Third International Conference on Digital Information and Communication Technology and its Applications (DICTAP2013)*, Ostrava, Chech Republic, pp. 31–39.

Anderson, J. C. and Gerbing, D. W. (1984). The effect of sampling error on convergence, improper solutions, and goodness-of-fit indices for maximum likelihood confirmatory factor analysis. *Psychometrika*, **49**: 155–173.

Arpaci, I., Yardimci, Y. C. and Turetken, O. (2013). The impact of cultural differences on smartphone adoption by organizations. In *2013 Third International Conference on Innovative Computing Technology (INTECH)*, London, UK, pp. 421–423.

Arruda-Filho, E. J., Cabusas, J. A. and Dholakia, N. (2010). Social behavior and brand devotion among iPhone innovators. *International Journal of Information Management*, **30**: 475–480.

Belk, R. W. (1974). An exploratory assessment of situational effects in buyer behavior. *Journal of Marketing Research*, **11**: 156–163.

Belk, R. W. (1975). Situational variables and consumer behavior. *Journal of Consumer research*, **2**: 157–164.

Boomsma, A. (1982). The robustness of LISREL against small sample sizes in factor analysis models. *Systems Under Indirect Observation: Causality, Structure, Prediction, (part 1)*, eds. K. G. Jöreskog and H.Wold. North-Holland, Amsterdam, pp. 148–173.

Boontarig, W., Chutimaskul, W., Chongsuphajaisiddhi, V. and Papasratorn, B. (2012). Factors influencing the Thai elderly intention to use smartphone for e-Health services. In *2012 IEEE Symposium on Humanities, Science and Engineering Research (SHUSER)*, pp. 479–483.

Butler, M. (2011). Android: Changing the mobile landscape. *Pervasive Computing, IEEE*, **10**: 4–7.

Carayannis, E. G. and Clark, S. C. (2011). Do smartphones make for smarter business? The smartphone CEO study. *Journal of the Knowledge Economy*, **2**: 201–233.

Chen, J. V., Yen, D. C. and Chen, K. (2009). The acceptance and diffusion of the innovative smart phone use: A case study of a delivery service company in logistics. *Information & Management*, **46**: 241–248, 2009.

Chin, W. W. and Newsted, P. R. (1999). Structural equation modeling analysis with small samples using partial least squares. *Statistical strategies for small sample research*, ed. R.Hoyle. Sage, Beverly Hills, Vol. 1, pp. 307–341.

Choudrie, J., Pheeraphuttharangkoon, S., Zamani, E. and Giaglis, G. (2014). Investigating the adoption and use of smartphones in the UK: A silver-surfers perspective. University of Hertfordshire Working Paper.

Chun, H., Lee, H. and Kim, D. (2012). The integrated model of smartphone adoption: Hedonic and utilitarian value perceptions of smartphones among Korean college students. *Cyberpsychology, Behavior, and Social Networking*, **15**: 473–479.

Chtourou, M. S. and Souiden, N. (2010). Rethinking the TAM model: Time to consider fun. *Journal of Consumer Marketing*, **27**: 336–344.

Commission, C. A. I. T. (2010). On the internet ecosystem in Saudi Arabia. Available at: http://www.citc.gov.sa/English/Reportsandstudies/Reports/Documents/IT%20006%20E%20-%20IT%20Report%202010.pdf.

Dai, H. and Palvi, P. C. (2009). Mobile commerce adoption in China and the United States: A cross-cultural study. *ACM SIGMIS Database*, **40**: 43–61.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology, *MIS Q*, **13**: 319–340.

Davis, F. D., Bagozzi, R. P. and Warshaw, P. R. (1992). Extrinsic and intrinsic motivation to use computers in the workplace. *Journal of Applied Social Psychology*, **22**: 1111–1132.

Dillon, A. and Morris, M. G. (1996). User acceptance of new information technology: Theories and models. *Annual Review of Information Science and Technology*, **14**: 3–32.

Ding, L., Velicer, W. F. and Harlow, L. L. (1995). Effects of estimation methods, number of indicators per factor, and improper solutions on structural equation modeling fit indices. *Structural Equation Modeling: A Multidisciplinary Journal*, **2**: 119–143.

Dodds, W. B., Monroe, K. B. and Grewal, D. (1991). Effects of price, brand, and store information on buyers' product evaluations. *Journal of Marketing Research (JMR)*, **28**: 307–319.

Finch, J. F. and West, S. G. (1997). The investigation of personality structure: Statistical models. *Journal of Research in Personality*, **31**: 439–485.

Fishbein, M. and Ajzen, I. (1975).*Belief, Attitude, Intention and Behaviour: An Introduction to Theory and Research.* Addison-Wesley, Reading, MA.

Gale, N. K., Heath, G., Cameron, E., Rashid, S. and Redwood, S. (2013). Using the framework method for the analysis of qualitative data in multi-disciplinary health research. *BMC Medical Research Methodology*, **13**: 117.

Gao, S., Yang, Y. and Krogstie, J. (2015). The adoption of smartphones among older adults in China. In *Information and Knowledge Management in Complex Systems*, eds. K. Liu, K. Nakata, W. Li and D. Galarreta. Springer, Cham, pp. 112–122.

Goldman, S. M. (2010). Transformers. *Journal of Consumer Marketing*, **27**: 469–473.

Goodhue, D. L. and Thompson, R. L. (1995). Task-technology fit and individual performance, *MIS Q*, **19**: 213–236.

Hair, J. F., Black, W., Babin, B. J. and Anderson, R. E. (2010). *Multivariate Data Analysis*, 7th edn. Pearson, New York.

Hall, S. P. and Anderson, E. (2009). Operating systems for mobile computing. *Journal of Computing Sciences in Colleges*, **25**: 64–71.

Harmon, R. R. and Laird, G. (2000). Linking marketing strategy to customer value: Implications for technology marketers. In *Innovation in Technology Management-The Key to Global Leadership. PICMET'97: Portland International Conference on Management and Technology*, Portland, Oregon, USA, pp. 896–900.

Haywood, A. and Boguslawski, G. (2009). I Love My iPhone... But There Are Certain Things That 'Niggle'Me. In *Human-Computer Interaction. New Trends*, ed. J. A. Jacko. Springer, Berlin, pp. 421–430.

Herbig, P. A. and Palumbo, F. (1994). The effect of culture on the adoption process: A comparison of Japanese and American behavior. *Technological Forecasting and Social Change*, **46**: 71–101.

Hill, C. E., Loch, K. D., Straub, D. and El-Sheshai, K. (1998). A qualitative assessment of Arab culture and information technology transfer. *Journal of Global Information Management (JGIM)*, **6**: 29–38.

Ho, S.-C., Sun, W.-Y. and Wang, Y.-M. (2011). Investigation of factors influencing the adoption of mobile data services. In *Proceedings of the 13th International Conference on Electronic Commerce*, Liverpool, United Kingdom, pp. 1–8.

Hong, S.-J., Tam, K. Y. and Kim, J. (2006). Mobile data service fuels the desire for uniqueness. *Journal of Communications of the ACM*, **49**: 89–94.

Hooper, D., Coughlan, J. and Mullen, M. (2008). Structural equation modelling: Guidelines for determining model fit. *Electronic Journal of Business Research Methods*, **6**: 53–60.

Hurley, A. E., Scandura, T. A., Schriesheim, C. A., Brannick, M. T., Seers, A., Vandenberg, R. J. and Williams, L. J. (1997). Exploratory and confirmatory factor analysis: Guidelines, issues, and alternatives. *Journal of Organizational Behavior*, **18**: 667–683.

Iacobucci, D. (2010). Structural equations modeling: Fit indices, sample size, and advanced topics. *Journal of Consumer Psychology*, **20**: 90.

Jarvis, C. B., MacKenzie, S. B. and Podsakoff, P. M. (2003). A critical review of construct indicators and measurement model misspecification in marketing and consumer research. *Journal of Consumer Research*, **30**: 199–218.

Information, C. D. O. S. (2014). Population (15 years and over) by age groups and educational status. Available at: http://www.cdsi.gov.sa/english/index.php?option=com_docman&Itemid=161.

Information, C. D. O. S. A. (2015). Estimate of population by sex and nationality. Available at: http://www.cdsi.gov.sa/english/index.php?option=com_docman&Itemid=160.

Je Ho, C. and Myeong-Cheol, P. (2005). Mobile internet acceptance in Korea. *Internet Research: Electronic Networking Applications and Policy*, **15**: 125–140.

Kang, Y. M., Cho, C. and Lee, S. (2011). Analysis of factors affecting the adoption of smartphones. In *1st International Technology Management Conference (ITMC)*, San Jose, CA, United States, pp. 919–925.

Kaplan, A. M. (2012). If you love something, let it go mobile: Mobile marketing and mobile social media 4x4. *Business Horizons*, **55**: 129–139.

Kargin, B., Basoglu, N. and Daim, T. (2008). Exploring mobile service adoption: A conjoint model. In *Portland International Conference on Management of Engineering and Technology (PICMET)*, Portland, Oregon, USA, pp. 2623–2633.

Kargin, B., Basoglu, N. and Daim, T. (2009). Factors affecting the adoption of mobile services. *International Journal of Services Sciences*, **2**: 29–52.

Khatib, A. M. (2012). Oil and infrastructure expenditures in Saudi Arabia. *Journal of Business Studies Quarterly*, **4**: 72–76.

Kijsanayotin, B., Pannarunothai, S. and Speedie, S. M. (2009). Factors influencing health information technology adoption in Thailand's community health centers: Applying the UTAUT model. *International Journal of Medical Informatics*, **78**: 404–416.

Kim, H.-W., Chan, H. C. and Gupta, S. (2007). Value-based adoption of mobile internet: An empirical investigation. *Decision Support Systems*, **43**: 111–126.

Kim, S. and Garrison, G. (2009). Investigating mobile wireless technology adoption: An extension of the technology acceptance model. *Information Systems Frontiers*, **11**: 323–333, 2009.

Kim, S. and Song, Y. (2009). Determinants influencing individuals' likelihood of adopting and actual use of blueberry. *Journal of Applied Sciences*, **9**: 3662–3671.

Kim, S. H. (2008). Moderating effects of job relevance and experience on mobile wireless technology acceptance: Adoption of a smartphone by individuals. *Information & Management*, **45**: 387–393.

Koenig-Lewis, N., Palmer, A. and Moll, A. (2010). Predicting young consumers' take up of mobile banking services. *International Journal of Bank Marketing*, **28**: 410–432.

Krieger, Z. (2007). Saudi Arabia puts its billions behind Western-style higher education. *The Chronicle of Higher Education*, **54**: A1.

Lai, I. K. and Lai, D. C. (2013). User acceptance of mobile commerce: An empirical study in Macau. *International Journal of Systems Science*, **45**: 1321–1331.

Lee, S. Y. (2014). Examining the factors that influence early adopters' smartphone adoption: The case of college students. *Telematics and Informatics*, **31**: 308–318.

Ling, M. and Yuan, P. (2012). An empirical research: Consumer intention to use smartphone based on consumer innovativeness. In *2012 2nd International Conference on Consumer Electronics, Communications and Networks (CECNet)*, Three Gorges, China, pp. 2368–2371.

Lu, J., Liu, C., Yu, C. S. and Yao, J. E. (2003). Exploring factors associated with wireless internet via mobile technology acceptance in Mainland China. *Communications of the International Information Management Association*, **3**: 101–120.

Luqman, F. (2013). KAUST will become one of the best in the world. Available at: http://www.arabnews.com/news/461379.

Mallat, N. (2007). Exploring consumer adoption of mobile payments — A qualitative study. *Journal of Strategic Information Systems*, **16**: 413–432.

Maloney, C. (2009). The Newton ball multi-National diffusion acceleration effect: An apple iPhone case study. Available at: http://chrismaloney.files.wordpress.com/2009/06/newton-ball-multi-national-diffusion-acceleration-effect-an-apple-iphone-case-study1.pdf.

Mansouri, N. Y., Crookes, R. J. and Korakianitis, T. (2013). A projection of energy consumption and carbon dioxide emissions in the electricity sector for Saudi Arabia: The case for carbon capture and storage and solar photovoltaics. *Energy Policy*, **63**: 681–695.

McKenna, A., McMartin, F., Terada, Y., Sirivedhin, V. and Agogino, A. (2001). A framework for interpreting students' perceptions of an integrated curriculum. In *Proceedings, 2001 ASEE Annual Conference and Exposition*. Vancouver, British Columbia.

Meyer, M. A. and Booker, J. M. (2001). *Eliciting and Analyzing Expert Judgment: A Practical Guide*. Vol. 7. SIAM, Philadelphia.

Monitor, I. (2014, July 21). Opportunity knocks in Saudi Arabia. Available at: http://monitor.icef.com/2012/01/opportunity-knocks-in-saudi-arabia/.

Moore, G. C. and Benbasat, I. (1991). Development of an instrument to measure the perceptions of adopting an information technology innovation. *Information Systems Research*, **2**: 192–222.

Mulaik, S. A., James, L. R., Van Alstine, J., Bennett, N., Lind, S. and Stilwell, C. D. (1989). Quantitative methods in psychology. *Psychological Bulletin*, **105**: 430–445.

Müller, R. M., Kijl, B. and Martens, J. K. (2011). A comparison of inter-organizational business models of mobile app stores: There is more than open vs. closed. *Journal of Theoretical and Applied Electronic Commerce Research*, **6**: 63–76.

Nanda, P., Bos, J., Kramer, K.-L., Hay, C. and Ignacz, J. (2008). Effect of smartphone aesthetic design on users' emotional reaction: An empirical study. *The TQM Journal*, **20**: 348–355.

News, A. A. (2015). All Saudi students in U.S. included in King's scholarship program. Available at: http://english.alarabiya.net/en/perspective/features/2015/09/06/All-Saudi-students-in-U-S-included-in-kingdom-s-scholarship-program.html.

Page, T. (2013). Usability of text input interfaces in smartphones. *Journal of Design Research*, **11**: 39–56.

Pan, D., Chen, N. and Rau, P.-L. P. (2013). The acceptance and adoption of smartphone use among Chinese college students. In *Cross-Cultural Design. Methods, Practice, and Case Studies*, ed. P. L. P.Rau. Springer, Berlin, pp. 450–458.

Pan, S. and Jordan-Marsh, M. (2010). Internet use intention and adoption among Chinese older adults: From the expanded technology acceptance model perspective. *Computers in Human Behavior*, **26**: 1111–1119.

Park, J., Yang, S. and Lehto, X. (2007). Adoption of mobile technologies for Chinese consumers. *Journal of Electronic Commerce Research*, **8**: 196–206.

Park, Y. and Chen, J. V. (2007). Acceptance and adoption of the innovative use of smartphone. *Industrial Management & Data Systems*, **107**: 1349–1365.

Persaud, A. and Azhar, I. (2012). Innovative mobile marketing via smartphones: Are consumers ready? *Marketing Intelligence & Planning*, **30**: 418–443.

Phan, K. and Daim, T. (2011). Exploring technology acceptance for mobile services. *Journal of Industrial Engineering and Management*, **4**: 339–360.

Qobo, M. and Soko, M. (2010). Saudi Arabia as an Emerging Market: Commercial Opportunities and Challenges for South Africa. Available at: http://dspace.cigilibrary.org/jspui/handle/123456789/30038.

Que, J. and Hurtado, V. (2013). The rise of Saudi Arabian telecoms: Unrivalled promise and opportunity in a vibrant market. Available at: http://www.deltapartnersgroup.com/our_insights/whitepapers/the-rise-of-saudi-telecoms-unrivalled-promise-and-opportunity-in-a-vibrant-market.

Ritchie, J., Lewis, J., Nicholls, C. M. and Ormston, R. (2013). *Qualitative Research Practice: A Guide for Social Science Students and Researchers*. Sage, Thousand Oaks, CA.

Rogers, E. M. (2003). *Diffusion of Innovations*, 5th edn. Free Press, New York.

Rohm, A. J., Gao, T. T., Sultan, F. and Pagani, M. (2012). Brand in the hand: A cross-market investigation of consumer acceptance of mobile marketing. *Business Horizons*, **55**: 485–493.

Saddik, B., Barakah, D. and Aldosari, B. (2012). A study of PDA and Smartphone adoption rates at King Saud Medical City Hospitals. In *2012 6th International Symposium on Medical Information and Communication Technology (ISMICT)*, La Jolla, USA, pp. 1–3.

Sang Hyun, K. (2008). Moderating effects of job relevance and experience on mobile wireless technology acceptance: Adoption of a smart phone by individuals. *Information and Management*, **45**: 387–393.

Santhipriya, S., Sastry, B. and Akshitha, K. (2011). Securing smartphone apps in online environment. *International Journal of Mathematical Archive (IJMA)*, **2**(11): 2462–2469.

Scarsella, A. (2019). Worldwide Mobile Phone Forecast Update, 2019–2023, Jun 2019 — Market Forecast — Doc # US45234919. Available at: https://www.idc.com/getdoc.jsp?containerId=US45234919.

Sekaran, U. (2003). *Research Methods for Business: A Skill Building Approach*, 4th edn. John Wiley & Sons, New York.

Seliaman, M. E. and Al-Turki, M. (2012). Mobile learning adoption in Saudi Arabia. *International Journal of Computer, Electrical, Automation, Control and Information Engineering*, **6**(9): 1129–1130.

Seneler, C. O., Basoglu, N. and Daim, T. U. (2008). A taxonomy for technology adoption: A human computer interaction perspective. In *Portland International Conference on Management of Engineering & Technology, 2008. PICMET 2008*, Portland, Oregon, USA, pp. 2208–2219.

Shin, D.-H. (2007). User acceptance of mobile Internet: Implication for convergence technologies. *Interacting with Computers*, **19**: 472–483.

Simsim, M. T. (2011). Internet usage and user preferences in Saudi Arabia. *Journal of King Saud University-Engineering Sciences*, **23**: 101–107.

Song, Y. and Han, J. (2009). Is enjoyment important? An empirical research on the impact of perceive enjoyment on adoption of new technology. In *International Conference on Information Management, Innovation Management and Industrial Engineering*, pp. 511–514.

Stephens, J. C., Hernandez, M. E., Román, M., Graham, A. C. and Scholz, R. W. (2008). Higher education as a change agent for sustainability in different cultures and contexts. *International Journal of Sustainability in Higher Education*, **9**: 317–338.

Straub, D., Keil, M. and Brenner, W. (1997). Testing the technology acceptance model across cultures: A three country study. *Information & Management*, **33**: 1–11.

Straub, D. W. (1994). The effect of culture on IT diffusion: E-mail and FAX in Japan and the US. *Information Systems Research*, **5**: 23–47.

Sun, H. and Zhang, P. (2008). An exploration of affect factors and their role in user technology acceptance: Mediation and causality. *Journal of the American Society for Information Science and Technology*, **59**: 1252–1263.

T. C. A. I. T. C. (CITC). (2014). *Establishment Report*. Available at: http://www.citc.gov.sa/English/AboutUs/AreasOfwork/Pages/default.aspx.

Tornatzky, L. G. and Klein, K. J. (1982). Innovation characteristics and innovation adoption-implementation: A meta-analysis of findings. *IEEE Transactions on Engineering Management*, **EM-29**: 28–45.

Tseng, F. M., Liu, Y. L. and Wu, H. H. (2014). Market penetration among competitive innovation products: The case of the Smartphone Operating System. *Journal of Engineering and Technology Management*, **32**: 40–59.

Van Everdingen, Y. M. and Waarts, E. (2003). The effect of national culture on the adoption of innovations. *Marketing Letters*, **14**: 217–232.

Vannoy, S. A. and Palvia, P. (2010). The social influence model of technology adoption, *Communications of the ACM*, **53**: 149–153.

Venkatesh, V., Morris, M. G., Davis, G. B. and Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *Management Information Systems (MIS)*, **27**: 425–478.

Venkatesh, V., Thong, J. and Xu, X. (2012). Consumer acceptance and use of information technology: Extending the unified theory of acceptance and use of technology. *MIS Quarterly*, **36**: 157–178.

Verkasalo, H. (2010). Analysis of smartphone user behavior. In *Ninth International Conference on Mobile Business and Global Mobility Roundtable (ICMB-GMR)*, pp. 258–263.

Verkasalo, H., López-Nicolás, C., Molina-Castillo, F. J. and Bouwman, H. (2010). Analysis of users and non-users of smartphone applications. *Telematics and Informatics*, **27**: 242–255.

Ward, S. and Robertson, T. S. (1973). Consumer behavior research: Promise and prospects. *Consumer Behavior: Theoretical Sources*, eds. Scott Ward and Thomas S. Robertson. Prentice-Hall, Englewood Cliffs, pp. 3–42.

West, J. and Mace, M. (2010). Browsing as the killer app: Explaining the rapid success of Apple's iPhone. *Telecommunications Policy*, **34**: 270–286.

Williams, B., Brown, T. and Onsman, A. (2012). Exploratory factor analysis: A five-step guide for novices. *Australasian Journal of Paramedicine*, **8**: 1.

Wu, J.-H. and Wang, S.-C. (2005). What drives mobile commerce? An empirical evaluation of the revised technology acceptance model. *Information & Management*, **42**: 719–729.

Zhou, T., Lu, Y. and Wang, B. (2010). Integrating TTF and UTAUT to explain mobile banking user adoption. *Computers in Human Behavior*, **26**: 760–767.

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