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

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Abstract--This paper starts with a preliminary theoretical research model which is developed based on the Unified Theory of Acceptance and Use of Technology (UTAUT). A number of qualitative methods, namely brainstorming, focus group and individual interviews, have been conducted to evaluate, select and validate the existing factors, as well as introduce new factors, to identify only the most related factors to be included in the preliminary research model. A survey questionnaire has been developed and validated to survey general users of the Smartphone in Saudi Arabia. A web-based survey has been designed and sent through email to 5,000 randomly selected smartphones users in Saudi Arabia. Data has been statistically analyzed using Structural Equation Modeling (SEM). The results indicate that performance expectancy construct, effort expectancy construct, brand influence construct, perceived enjoyment construct and design construct have a positive and significant relationship with users' behavioral intention to adopt and use smartphones in Saudi Arabia. Also, the results indicate that social influence construct has a significant and positive relationship with use behavior or actual use of smartphones in Saudi Arabia.

I. INTRODUCTION

The Smartphone market is expected to reach \$258 billion globally by the end of year 2015 [1]. Studying and understanding users' adoption and use of new technologies is very critical for both researchers and practitioners [2]. Users' acceptance of a new information technology (IT) is considered to be a key determinant of its success and their lack of acceptance is considered to be an obstacle to its success [3]. Moreover, understanding users' adoption and use of new IT plays an important role in determining users' needs and reducing business risk, especially with rapid changes in the IT such as Smartphone technology. [4]. 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 [5]. In a number of empirical studies, scholars studied the adoption and use of Smartphone technologies in Saudi Arabia, including the adoption of mobile internet [6], adoption and use of e-services [7], and acceptance and use of Information Technology (IT) [5]. The Saudi Arabian economy is growing fast and it is supporting the significant expansion of its

telecommunication sector which has had less than ten years of experience in an open competition market [8][9]. 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.

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 [10]. 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 [11] defined users' acceptance as "the demonstrable willingness within users group to employ information technology for the tasks it is designed to support." Rogers [12] 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 ten characteristics were specified by Tornatzky and Klein [13], including the five that were identified by Rogers, they added five more attributes namely: cost, communicability, divisibility, profitability, and social approval. Alavi and Joachimsthaler 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 [14]. As a result of a comprehensive literature search the research gaps shown in Table 1 were identified. The same table also lists the research objectives.

Based on the research reviewed in this review [22], a taxonomy has been developed that includes the research topic, theory or model used, variables identified in the research.

According to Sekaran [38], 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 [22].

TABLE 1: SUMMARY OF THE RESEARCH GAPS, OBJECTIVES AND QUESTIONS [21, 22]

Research Gaps	Research Objectives	Research Questions
Most of the empirical research that was previously reviewed focused only on limited aspects of the factors may influence users' adoption and use of smartphones and that neglects other important adoption factors.	<p>To explore and study the key factors that are associated with users' adoption and use of smartphones in Saudi Arabia</p> <p>Developing a research model based on the existing IT models that include important factors identified, reviewed, evaluated through a number of qualitative methods to better study the key factors that associated with users' adopt and use of the Smartphone in Saudi Arabia.</p>	What are the key factors that are associated with general users' behavioral intention to adopt and use the Smartphone technology in Saudi Arabia?
Many empirical researchers studied the adoption and use of the smartphones as if Smartphone were a tool to be used in specific task such as using it in healthcare.		
There is a lack of empirical research that studies and investigates the key factors that influence the acceptance and use of Smartphone technology in comprehensive approach, particularly in Saudi Arabia.		How can general users' experience with the Smartphone technology be enhanced in Saudi Arabia?
Most of the empirical research studies related to the adoption of the Smartphone technology have applied the Technology Acceptance Model (TAM). However, a number of scholars indicated that TAM is able to explain only about 40% of variances in technology acceptance.		

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 [26, 39, 23, 37, 35, 40, 16] -Job Relevancies [29, 35] -Relative advantage [41].	Perceived ubiquity [42, 29]. Perceived reachability [29]. Mobility [43]. Accuracy [42]. Controllability [41]. Security [41]. Perceived availability [39, 35]. Perceived quality [35]. Content [25, 43]. Screen size [25]. Service speeds [43]. Multimedia [23]. Applications [23]. Wireless Internet [23]. Task [26, 31, 44].
Effort Factors	-Ease of Use [39, 23, 37, 31, 35]. -Effort expectancy [41].	Simplicity [25]. Design [23]. Complexity [41].
Social Influence Factors		Self-efficacy [31]. Social norm [24]. Social pressure [35].
Facilitating Conditions	-Compatibility [31, 35]. -Behavior control [24].	Perceived security [41]. Environments [26, 31]. Organizational [26, 31]. Compatibility [26, 37, 31]. Internal environment [35]. External environment [35]. Perceived cost [37]. Cost [25]. Perceived cost saving [30]. Perceived fee [45] Company willingness to found [30].
Hedonic Factors		Enjoyment [43]. Perceived enjoyment [35, 46, 24]. Fun [36]. Entertainment utility [27].

II. THEORY DEVELOPMENT

After reviewing many related research studies and theoretical models, the UTAUT appeared to be a suitable theoretical model as a basis for this research model. Through an extensive literature review, more than forty Smartphone adoption-related factors were initially identified. These factors were quantitatively and qualitatively reviewed, evaluated, filtered and validated to select the factors to be included in the research model. 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 below [47], [48], [49], [50], [51], [52], [53], [54].

There were a total of thirty three participants; six participants in the brainstorming session, seven participants in the focus group session and twenty participants in the

individual face-to-face interviews. Eight factors were selected by at least two-thirds (22) of the participants.

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” [16]. The Smartphone provides users with many features and benefits that can help to improve their overall performance. Choudrie et al. [28] studied the adoption and use of the Smartphone by older adults in the United Kingdom. Their finding showed that the performance expectancy construct has the strongest influence on intention to adopt and use Smartphone technology [28]. 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.

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, individuals' 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.

B2: Effort expectancy construct: defined as “the degree of ease associated with the use of systems” [16], 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 [25], design [23], and complexity [41]. These factors were either directly associated with the effort expectancy construct or through other factors such as the ease of use factor [39, 23, 37, 31, 35]. Boontarig et al. [34] found that effort expectancy factor has a significant influence on the Thai elderly’s intention to use the Smartphone for e-health services. 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 [55, 56]. Economic factors were identified as a construct that can predict users’ behavioral intention to adopt and use new IT [56]. 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 [56]. Kim [30] studied the factors that influence users to adopt and use mobile wireless technology (MWT) via the Smartphone technology. Kim et

al. [45] found that, cost, or the price of mobile internet, had a significant relationship with users’ intention to adopt mobile technology [45]. A number of factors related to economic factors, perceived cost [37], perceived cost saving [30], and company willingness to found [30] 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 [57, 58]. Based on Ganesh and Kumar’s work, Chris Maloney [58] developed a framework to explore the learning effects’ influence on the rate of adoption in the market and to explain the impact of the learning effect on the adoption rate of the iPhone [58]. Also, Kim and Song [57] developed their own research model that investigated the social, economic, and technological characteristics that influence individuals’ attitude toward adoption of a specific Smartphone device, namely Blueberry. The iPhone was the most studied Smartphone device in articles reviewed [59-63]. 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 [64]. Perceived enjoyment has been found to be a significant predictor of users' intention to adopt and use information technology [65, 66]. 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 [28, 64, 24]. 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 [67]. In research focused on undergraduate and graduate students in Korea, Kang et al. [23] found that design factor has a positive relationship with perceived usefulness, which, in return, have 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.

Situational factors

Consumer or users 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" [68]. Clearer accounting for situational variables can greatly improve the researcher's ability to predict and understand consumers' actual behavior [69]. Ward and Robertson stated that "situational variables may account for considerably more variance than actor related variables" [70]. 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 [71].

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" [16]. Subjective norms and social influence have been recognized as important aspects that influence users' adoption of a new technology [19]. A number of factors, namely self-efficacy [31], social norms [24], and social pressure [35] 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. [27] 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 [27]. Ling and Yuan [32] empirically study the factors that influence users' adoption and use the Smartphone in China and they found that, subjective norms were among the significant factors that have positive effects on users' adoption and use the Smartphone [32]. Scholars pointed out the important role of cultural factors and its influence on the adoption and use of new information technologies [5, 72-75]. 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" [16]. 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 [41], environments [26, 31], organizational [26, 31], compatibility [26, 37, 31], internal environment [35], and external environment [35], were determined in previous research as important factors that are associated with users' adoption and use of the Smartphone.

Boontarig et al. [34] found that the facilitating conditions construct has a significant influence on the Thai elderly's intention to use the Smartphone for e-health services [34]. Choudrie et al. [28] 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 [16].

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 [76, 16, 77]. 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.

III. RESEARCH DESIGN AND RESULTS

There are four main telecommunications companies in Saudi Arabia, which 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 type of customers. Each company has its own main branches and sub-branches in all 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 5,000 smartphones users who have been randomly selected from one of these four Saudi telecommunications companies.

After the design for the web-based survey has been finalized and activated, an invitation email with an electronic link to the web survey has been set to a randomly selected 5,000 possible participants. Out of the 5,000 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%). The final results of the SEM – full structural model is shown in figure 2 below.

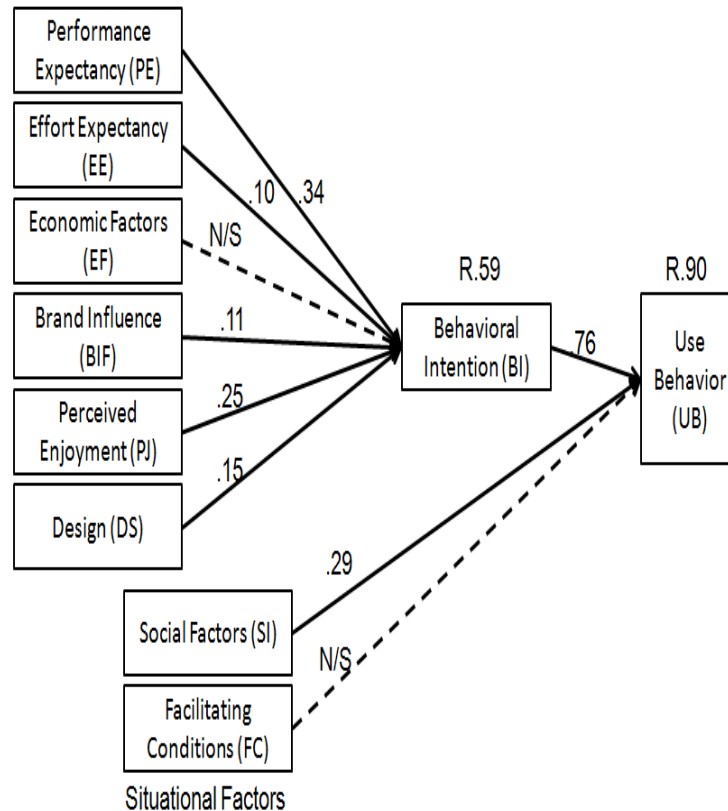


Figure 2 The results

IV. 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.

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.

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.

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.

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.

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.

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.

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.

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.

V. DISCUSSION AND CONCLUSIONS

Performance expectancy construct found to be a one of the key factors that could encourage and increase users' intention to adopt and use smartphone therefore it is recommended to improving the factors that contribute to the improvement of the performance of smartphones devices. These factors can be: providing a better combination of hardware and software to improve OS speed, visual quality, durability, battery life could encourage and increase users' intention to adopt and use smartphone

Perceived enjoyments found to be one of the factors that could increase users' intention to adopt and use smartphones therefore it is recommended to make smartphone more enjoyable for more users.

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