Developing and Validating an Instrument for Measuring Mobile Government Adoption in Saudi Arabia

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Abstract—Many governments recently started to change the ways of providing their services by allowing their citizens to access services from anywhere without the need of visiting the location of the service provider. Mobile government (M-government) is one of the techniques that fulfill that goal. It has been adopted by many governments. M-government can be defined as an implementation of Electronic Government (E-Government) by using mobile technology with the aim of improving service delivery to citizens, businesses and all government agencies. There have been several research projects developing models to understand the behavior of individuals towards the adoption of m-government. This paper proposes a model for adoption of m-government services in Saudi Arabia by extending Technology Acceptance Model (TAM) by introducing external factors. This paper also reports on the development of a survey instrument designed to measure user perception of mobile government acceptance. A survey instrument has been developed by using existing scales from prior instruments and a pilot study has been conducted by distributing the survey to 33 participants. As a result, a survey instrument has been refined to retain 43 items. The results also showed that the reliabilities of all the scales in the survey instrument are above the levels acceptable in current academic research, thus the instruments developed by us are capable of analyzing the factors in M-government adoption.

Keywords—TAM, m-government, e-government, model, acceptance.

I. INTRODUCTION

E-GOVERNMENT was defined by [1] as the use of technologies to "enhance the access to and the delivery of government information and services to citizens, businesses, government employees, and other agencies". E-government was also defined by [2] as "the communication between the government and its citizens through the electronic environment". Accessing the internet is based on various devices, mainly landlines and wireless whereas, m-government uses devices such as cellular telephones, PDA-s, smart phones, and laptops. Many researchers consider m-Government as complementarity to e-Government [3]-[5], arguing that m-Government is founded on the same principles as e-Government, to which it simply adds some distinctive features. These features can be summarized as follows: 1) mobile phones are always turned on, which will make it easy

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for a citizen to receive messages from government service providers at any time [3]; 2) mobile phones became very efficient means of communication between people either in advanced or developed countries, rendering it a crucial part of their daily life; therefore, citizens might benefit from government services easily via mobile [3]; 3) mobile phones are progressively more being used to access the web. They are expected to override the use of Personal Computers (PC-s) [3], which saves time and travel to the location of the service provider; 4) the main advantage of m-government for citizens resides in its mobility, which permits accessing the network at any time and from anywhere [3]. The economic development of each country may limit the access to the internet. This limitation affects the availability of computers and the penetration of the broadband.

Although M-government has emerged several years ago, these services are still in their early stage in developing countries in general, and in Saudi Arabia in particular. As any newly introduced concept into society, M-government is facing many difficulties in developing countries and not always accepted. There are many factors influencing the acceptance of M-government in developing countries including the educational level, and the cost and complexity of use of the mobile and computer technology. Governments in developing countries in general, and in Saudi Arabia in particular, are paying more attention towards the adoption of M-government services by its nationals. This could be accomplished, for example, by considering criteria that help making mobile services easily accepted by citizens, for example by implementing services that are user-friendly and that are adequate to citizen needs. Our study is focusing on the adoption of M-government in Saudi Arabia. Our research question is: "What are the factors which influence the adoption of M-government in Saudi Arabia?" Answering this research question will enhance the knowledge in this field by developing a conceptual model for citizens' adoption of M-government in developing countries, with a specific focus on Arabic world. In order to achieve this goal, our study aims to conceive a model which explores perceived service quality, user's satisfaction and perceived mobility dimensions in m-Government context. This model should allow assessing user's satisfaction through perception of perceived responsiveness, perceived reliability, and perceived empathy. Also, it will assess the user intention of using m-Government through perceived trustworthiness and perceived mobility. Finally, the actual use of mobile government services will be

assessed by user's satisfaction and the user intention of using m-Government.

This paper developed an adoption model based on Technology Acceptance Model (TAM) extended by external factors which are perceived mobility, perceived service quality, user's satisfaction and perceived trustworthiness, so we first overview that model After that, this paper presents a survey instrument which was developed by using some existing scales from the prior instruments. Finally, this paper presents a pilot study which was conducted by distributing the survey to the participants, with the estimates of the reliabilities of all the scales in the survey instrument.

II. THEORETICAL FRAMEWORK

A. Closely Related Works

There are many studies which highlight the users' intention to use services in m-Government, e-Government, mobile data services, and 3G services. For example, [13] highlights the adoption of m-Government services in Jordan. Their study was based on the UTAUT model (Unified Theory of Acceptance and Use of Technology) extended by two components: trust and privacy. However, [26] was interested in studying 3G services that they considered as a mobile technology; so, they developed a model to study users' perceptions of adopting 3G services. The developed model was based on Technology Acceptance Model (TAM) and on specific service quality factors that influence users' satisfaction. In [17], the focus was made on exploring factors that might affect the citizens' adoption of e-Government services in Jordan. More specifically, a conceptual framework was developed based on the TAM. Their framework aimed to explore the links that exists between specific factors (trustworthiness, service quality and citizen satisfaction) and citizens' adoption of e-Government services. From another side, [23] focused on factors that affect consumers' behavioural intention towards using mobile data services. Their model based on perceived usefulness, perceived enjoyment, perceived mobility, social influence, perceived ease of use, media influence and perceived monetary value.

After reviewing the previous studies, the following points need to be mentioned:

- The acceptance of e-Government in Saudi Arabian context has not yet been sufficiently covered [25].
- The acceptance and use of m-Government services in Saudi Arabian has not yet been sufficiently investigated [25].

B. Conceptual Model

There have been many developed models which aim to study and investigate the factors that affect the usage of technology in a specific society. Amongst those is the TAM (Technology Acceptance Model). The model is based on 5 constructs: perceived usefulness, perceived ease of use, attitude towards use, intention to use and actual use. Some of these constructs are affecting others, for instance the construct perceived usefulness affects the construct intention to use, and the construct attitude towards use has an impact on the construct intention to use. TAM was used in many studies; so, many changes have been applied to it. Mainly with the addition of new constraints [4] or editing the links between existing constructs.

The model adopted in this study consists of TAM extended by including four more components: perceived mobility, perceived service quality, users' satisfaction, and trust. Various components are detailed in the following paragraphs:
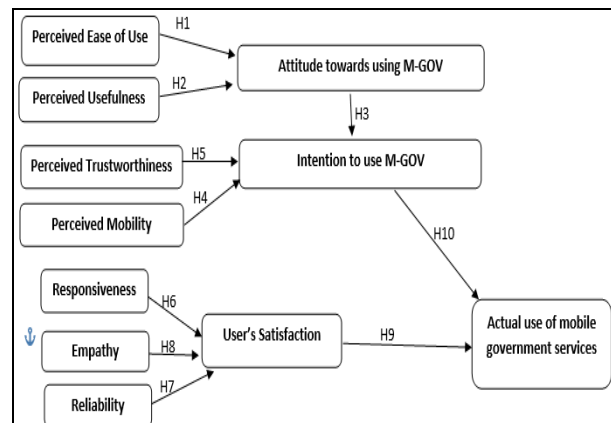

Fig. 1 The Proposed Model

1. Perceived Usefulness

Perceived usefulness (PU) is one the most significant constructs in TAM. PU stands for the user's perception about potential benefits of using the specific IT technology, and thus leads to continuing using it [5]. In the context of this study, PU is defined as the extent to which the users deem that they will benefit from the services of m-Government in their everyday life. The ability of user to connect to m-Government services should not mainly rely on time and location, which is known as service ubiquity. The ubiquity of services highlights the advantage of such mobile services. For instance, if citizens are aware that they have continuous access to a given service anytime they need it, then they will believe that the service is beneficial for them [6]. This usefulness of m-Government services will affect the user's attitude towards using mobile government services. Therefore, the following hypothesis can be formulated:

- Hypothesis 1: Perceived usefulness positively affects the user's attitude towards using mobile government services.

2. Perceived Ease of Use

Perceived ease of use (PEU) is one of the important components in TAM and influences the users' intention to use the technology [5]. In the context of this study, PEU is defined as the extent to which users believe that m-Government services are easy to use and effortless [6]. The complexity of use of technology has an impact on user's attitude towards using mobile government services. From another side, when m-Government services are easy to use, then users will be aware of the benefits of using them; so, users time and effort will be saved, which usually affect their attitude towards the service provided. Therefore, the following hypothesis can be

made:
- Hypothesis 2: The perceived ease of use positively affects the user's attitude towards using mobile government services.

3. The Attitude

The attitude toward use in the TAM model is defined as the mediating affective response between usefulness and ease of use beliefs and intentions to use a target system. In other words, a prospective user's overall attitude toward using a given system is an antecedent to intentions to adopt [5]. Therefore, there is a relationship between the user's attitude towards using mobile government services and intention to use mobile government services, so the following hypothesis can be formulated:
- Hypothesis 3: The attitude will have a significant positive effect on intention to use m-Government Services.

4. Perceived Mobility

Device mobility can be defined as its characteristic to handle information while in state of mobility [10]. This corresponds to the use of m-Government services without relying on time or location, and without the need for a wired network [10]. However, the need for mobility emerges when the user needs to access the internet quickly, whilst he/she is travelling or being distant from home or office. Perceived mobility refers to the extent to which mobile technologies can offer potential benefits. These benefits include communication, access to information and services and their availability anytime and anywhere. Mobility was considered in many studies as a crucial factor that influences the user's intention to adopt and use mobile services. However, the m-technology acceptance research did not allocate enough attention to the effects of mobility on IS adoption. Mobility characteristic of m-Government will increase the intention of the user to use m-Government services [10], which makes the following hypothesis:
- Hypothesis 4: Perceived mobility positively affects the user intention to use the m-Government services.

5. Perceived Trustworthiness

User trust is defined as a factor that determines the behavioral intention of users in environments containing some degree of transactional risk such as in e-Commerce [4]. User trust is a very important and significant factor and thus should be taken into account in environments that have a high degree of security risk like ubiquitous environments [11], [12]. The trust factor was recently studied in the context of E-Government [13]. The adoption of E-Government services by users is related to their belief of trustworthiness of the services and their delivery channel. This means that trust can be considered as an important factor that helps to predict the adoption of m-Government by users. This makes the following hypothesis:
- Hypothesis 5: Trust positively affects the user intention to use the m-Government services.

6. Perceived Service Quality

Service quality is an important issue in electronic services environments [14], and in public sector in general as well. Service quality can be defined as the discrepancy that exists between the perceptions and the expectations of a consumer regarding the services he/she receives from a specific service provider [15]. This is mainly accomplished by understanding citizens' needs and adapting the services to satisfy them [16]. Many studies have focused on the evaluation of service quality, e.g. in e-Government field [27]. However, the SERVQUAL scale is one of the service quality evaluation systems which were developed by [15]. This evaluation system was extensively used in order to evaluate customer perceptions of service quality. This scale is used to measure the quality of a service in five dimensions: tangibles, assurance, responsiveness, reliability, and empathy [15]. Of the five dimensions, only three (responsiveness, reliability and empathy) are applicable to measure the electronic government service quality [17], so those three are used to measure the mobile government in this study. Responsiveness concerns the perception of the user regarding the service provider and how responsive and helpful he is. Reliability means how accurately and dependably the offered service is performed. Finally, empathy refers to the interest and concern that a service provider shows to its customers. Services with a high quality will promote their usability by users, which leads to user satisfaction [18]. Therefore, the following hypothesis can be formulated:
- Hypothesis 6: Perceived responsiveness positively affects the citizens' satisfaction.
- Hypothesis 7: Perceived reliability positively affects the citizens' satisfaction.
- Hypothesis 8: Perceived empathy positively affects the citizens' satisfaction.

7. User's Satisfaction

If the user of a specific service is satisfied, he/she will continue to use it in the future [7]. User satisfaction factor has an impact on long-term organizational success and system usage [7]. User satisfaction can be defined as the perception of a pleasant fulfillment of a service [7], or the extent to which users believe that the information systems available to them meets their information requirements [8]. In the field of m-Government, user satisfaction is an important factor that affects the quality of delivered services, and thus will affect the actual use of m-Government services. In order to achieve this satisfaction, user's needs and perceptions should be taken into account [8]. The study [9] highlights the importance of integrating user satisfaction literature with technology acceptance literature. Therefore, the following hypothesis can be assumed:
- Hypothesis 9: User satisfaction positively affects the actual use of m-Government services

8. Intention to Use

The Intention to Use construct was derived from the Technology Acceptance Model (TAM). Reference [21] argues

that behavioral intention can be seen as a guide of how hard people are willing to try to perform a particular behavior. Consequently, [5] has extended the Intention to Use definition to include the intention to use technology. Reference [20] has also extended the definition of Intention to Use in the context of the adoption of mobile services. There is the relationship between the intention to use mobile government and the adoption of using mobile government services. Therefore, the following hypothesis can be assumed:

- Hypothesis 10: Intention to use mobile government services positively affects the actual use of m-Government services

III. METHODOLOGY

A. Data Collection

This pilot study was conducted at King Saud University in Riyadh which is the capital city of Saudi Arabia. Thirty-three (33) respondents including students, academic staff and administrative staff, were asked to complete the questionnaire. Three (3) were later rejected due to missing answers. The data from the remaining 30 respondents was analyzed using SPSS.

TABLE I
THE ITEMS OF THE QUESTIONNAIRE

Constructs	Code	Statements
Perceived Usefulness	PU1	"Using the mobile government services would be useful in my daily life"
	PU2	"Using the mobile government services would help me accomplish things more quickly"
	PU3	"Using the mobile government services would increase my productivity"
	PU4	"Using the mobile government services would help me perform many things more conveniently"
Perceived Ease of Use	PEU1	"I expect that learning how to use the mobile government Services would be easy for me"
	PEU2	"I expect that my interaction with the mobile government services would be clear and understandable"
	PEU3	"I would find mobile government services to be easy to use"
	PEU4	"I expect that it would be easy for me to become skillful at using the mobile government services"
Perceived Mobility	PM1	"I expect that I would be able to use mobile government services at any time, and anywhere"
	PM2	"I would find Mobile Government Services to be easily accessible and portable"
	PM3	"I expect that mobile government services would be available for use whenever I need it"
	PM4	"In general, I expect that I would have control over using mobile government services anytime and anywhere"
Responsiveness	RES1	"I believe that any mobile government services provider is never too busy to respond to citizen requests"
	RES2	"I believe that mobile government services providers give a prompt service"
	RES3	"There is a good respond from any mobile government services provider"
Reliability	REL1	"Mobile government services provider shows a sincere interest in solving some citizen problems"
	REL1	"Mobile government services provider provides easy to use tools for checking on the status of an ordered service"
	REL1	"Transactions with mobile government services provider are error-free"
	REL1	"Mobile government services provider delivers on its undertaking to do certain things by a certain time"
Empathy	EMP1	"Mobile government services provider offers a helpful assistance through SMS"
	EMP1	"Using mobile government services allows citizens to easily exchange ideas and opinions"
	EMP1	"Mobile government services provider has operating hours convenient to all its citizens"
	EMP1	"Mobile government services provider understand my specific needs"
Satisfaction	SAT1	"I am satisfied with the technical quality of mobile government services"
	SAT1	"I am satisfied with the information I receive from mobile government services"
	SAT1	"I am satisfied with the way in which mobile government providers adjust to my needs"
	SAT1	"Overall, I am satisfied with the services offered by mobile government providers"
Perceived Trustworthiness	PT1	"I expect that mobile government services will not take advantage of me"
	PT1	"I believe that mobile government services are trustworthy"
	PT1	"I believe that mobile government services will not act in a way that harms me"
	PT1	"I trust mobile government services"
Attitude towards using mobile government	ATT1	"Using mobile government services is a good idea"
	ATT1	"Using mobile government services is wise"
	ATT1	"Using mobile government services is beneficial"
	ATT1	"Using mobile government services is interesting"
Intention to use mobile government services	INT1	"Given the opportunity, I will use mobile government services"
	INT1	"I am likely to use mobile government services in the near future"
	INT1	"I am willing to use mobile government services in the near future"
	INT1	"I intend to use mobile government services when the opportunity arises"
Actual use of mobile government services	ACT1	"If m-government was implemented I would use it as a primary mean of transacting with the government"
	ACT1	"I would use m-government as an alternative to traditional ways of transacting with the government"
	ACT1	"I will use m-government services as soon as I can do so"
	ACT1	"Overall, I would use m-government services in Saudi if they were available"

TABLE II
GENERAL INFORMATION

Descriptive	answers	Frequency	Percentage
Gender	MALE	18	60.0
	FEMALE	12	40.0
	Total	**30**	**100**
Age	18-20	11	36.7
	27-30	3	10.0
	21-23	6	20.0
	31-35	3	10.0
	24-26	2	6.7
	36 and above	5	16.7
	Total	**30**	**100**
College	College of Science	6	20.0
	College of law	2	6.7
	College of Pharmacy	6	20.0
	College of Engineering	1	3.3
	College of Dentistry	1	3.3
	College of Medicines	4	13.3
	College of Computer Science	2	6.7
	College of Applied Health Sciences	3	10.0
	College of Education	2	6.7
	College of Business Administration	3	10.0
	Total	**30**	**100**
What is your highest level of education	Undergraduate	5	16.7
	Primary	18	60.0
	Post-graduate degree	7	23.3
	Total	**30**	**100**
What is your occupation	Student	19	63.3
	Administrative Staff	5	16.7
	Academic Staff	6	20.0
	Total	**30**	**100**
How often do you use mobile	Daily	27	90.0
	Two or three times a week	2	6.7
	Two or three times a month	1	3.3
	Total	**30**	**100**
For what purposes do you use the mobile	Shopping online, Communication, Government services, Entertainment	5	16.7
	Communication, Government services, Email, Information search	1	3.3
	Communication, Government service, Entertainment	4	13.3
	Communication, Entertainment	4	13.3
	Shopping online, Communication, Government service, Email, Entertainment	2	6.7
	Communication, Email Entertainment	1	3.3
	Shopping online, Communication, Government service, Email ,Entertainment, Information search	11	36.7
	Communication	1	3.3
	Shopping online, Communication, Government service, Entertainment, Information search	1	3.3
Have you ever used any Saudi mobile government service	**Total**	**30**	**100**
	YES	30	100
	NO	–	–
	Total	**30**	**100**

B. Questionnaire Development

We adapted our instruments from the prior research in m-Government context. In order to measure the TAM constructs (perceived ease of use, perceived usefulness, attitude towards use, intention to use and actual use, etc.), items from [5] have been used. The scale of perceived trustworthiness was measured using items from [19], whereas the scales of perceived mobility were measured using items adopted from [22]. In addition, the scales of perceived service quality were measured using items adopted from [17] which were originally suggested by [15]. Table I shows part of data instrument used to collect data (excluding demographic part). Finally, the five-point-Likert-type scale was used to measure items, ranging from "strongly agree" to "strongly disagree". The questionnaire was in Arabic, so here we present the translations.

IV. INSTRUMENT VALIDITY

A. The General Information about the Sample

Table II shows demographic information about the sample. Most of the respondents were males (18). The largest number of respondents belonging from the staff (Science and Pharmacy), were 12 (6 persons per each college). In terms of educational qualification, we find that most of the respondents have (secondary) degree. The use of mobile phone as "daily" - was reported by 27 individuals. The purposes for uses of mobile phones showed e-marketing, communication and government services, e-mail, entertainment and information search.

B. The Reliability of the Study

The reliability of a measure refers to the degree to which the instrument is free of random errors. It is concerned with consistency and stability of the measurement [24]. In this pilot study, detailed item analysis and reliability were used to fine-tune the measures of each construct. The measurement items were assessed and removed if shown to decrease the reliability of the instrument. To measure the reliability of our tools (questionnaire), we calculated Cronbach's alphas.

TABLE III
THE RELIABILITY OF THE STUDY

Constructs		Number of items	Cronbach's Alpha (α)	Specification
Perceived usefulness		4	.852	Good
Perceived ease of use		4	.904	Good
Perceived mobility		4	.892	Good
Perceived Services quality	Perceived responsiveness	3	.944	Good
	Perceived reliability	4		
	Perceived empathy	4		
Satisfaction		4	.918	Good
Perceived trustworthiness		4	.911	Good
Attitude towards use of mobile government services		4	.816	Good
Actual use of mobile government services		4	.775	Acceptable
Intention to use mobile government services		4	.919	Good
The overall of reliability coefficient		43	0.88	Good

According to [24], if the value of Cronbach's Alpha is smaller than 0.6 it is *poor*, if it is in the range of 0.60 to 0.80 it is considered *acceptable* and if it is above 0.80 it is considered *good*. Table III shows the reliability study tool transactions. The overall reliability coefficient is high (with the averaged one of 0.88) which suggests that the reliability was good for our field of study.

C. The Correlation Analysis

A correlation analysis was run based on each of these constructs, and the results are reported in Table IV. As it can be seen from the matrix, there is a significant relationship between actual use of mobile government services and the rest of constructs, although the relationship varies in strength from one construct to the next. For example, the results showed a strong correlation among all variables of the acceptance model. Perceived usefulness and Perceived Ease of Use correlate strongly with attitude towards use of mobile government services (Pearson's r =0.803) and (Pearson's r =0.797) respectively. This indicates that users' attitude towards use of mobile government services increases if they perceive the system as useful and easy to use. Perceived Service Quality (responsiveness, reliability and empathy) correlate strongly with User's Satisfaction (Pearson's r =0.626), (Pearson's r =0.855) and (Pearson's r =0.891) respectively. Perceived Trustworthiness and Perceived Mobility had a strong significant correlation with Intention to Use mobile government services (Pearson's r = 0.709) and (Pearson's r = 0.778) respectively. This result indicates that if users trust the mobile government services and use these services anywhere and anytime, their intention to use it will increase. The results showed also a strong correlation between Intention to Use mobile government services and User's Satisfaction with Actual use of mobile government services (Pearson's r =0.766) and (Pearson's r =0.795) respectively.

TABLE IV
THE CORRELATION BETWEEN THE VARIABLES

	PU	PE	MO	T	RS	RA	EM	SAT	ATT	IN
PE	.917									
MO	.850	.888								
T	.756	.711	.667							
RS	.967	.768	.686	.582						
RE	.861	.853	.814	.763	.720					
EM	.762	.776	.713	.787	.652	.869				
SA	.748	.724	.624	.834	.626	.855	.891			
AT	.803	.797	.708	.667	.481	.693	.673	.667		
IN	.812	.845	.778	.709	.527	.688	.669	.655	.951	
AC	.851	.833	.802	.783	.740	.798	.812	.795	.769	.766

PEU=Perceived ease of use; PU= Perceived usefulness; MO= Perceived mobility; T= Perceived trustworthiness; RS= Perceived responsiveness; RA= Perceived reliability; EM= Perceived empathy; SAT=User's satisfaction; ATT= Attitude towards to use; IN=Intention to use; AC=Actual use

V. CONCLUSION AND FUTURE WORK

This study focuses on validating the model that we have developed by integrating the constructs from the TAM (Technology Acceptance Model) and other external variables derived from the related literature, such as user's satisfaction, perceived service quality, perceived mobility and perceived trustworthiness. We think that the developed model will provide more knowledge to the fields of m-Government and technology adoption in general. Our study will help the decision makers in m-Government projects, and the mobile service providers to successfully interact with each other. Our suggested factors of adoption are: perceived trust, perceived service quality, perceived mobility and user's satisfaction. We have developed and validated our instrument for measuring those factors and the adoption of mobile government services. A pilot study with quantitative data analysis has been carried out to further ensure the validity of the instrument and improve its reliability, which was found to be well above the acceptable level. Last but not least, the findings in this pilot study provided the foundation for future discussions and instrument development efforts on user adoption of mobile

government services. There are ample opportunities for future research. First of all, we plan to validate this instrument in another round of study in the near future with a larger sample size. And the other reliability assessment technique, confirmatory factor analysis, is planned to be used to assess the instrument. Second, generalizability of the instrument can be increased by expanding this study to include individuals representing different developed and developing countries.

The limitation of this study was that it was carried out only within university environments we are also going to address that in future by covering wider population groups.

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