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Research Article

Impact Civil Conflicts, Information Quality, System Quality and Service Quality on the Net Benefits of M-government: An Empirical Study of Farmers' Southern Region of Iraq

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Abstract: Evaluation the Information System (IS) from the perspective of the net benefits of IS usage under unstable environment in developing countries, such as Iraq, is critical. For this purpose, this study aims to investigate mG success in the Iraqi context, where literature on this field of research is lacking. Today, ICTs promote development across many dimensions not only serving as one of the main resources for promoting products and services and for delivering and broadcasting information but also in connecting organizations and communities together in terms of better interaction and better communicational possibilities. Therefore, several governments have attempted to establish IS projects by exploiting modern ICTs. The Iraqi government has recently sought to harness these technologies to provide quality service for their citizens. Mobile technologies significantly increased among the Iraqi citizens, especially after 2003. ITU (International Telecommunication Union) (2013) reported mobile subscribers rates are forecast to a rise from 75% in 2013 to 95 by 2015 in Iraq. The reported noted that by 2013 Iraq is the highest mobile penetration rate amongst 34 countries. Despite the increase of the services offered by the government, few citizens have participated, according to a recent survey of the UN. Moreover, providing mobile Government (mG) services alone did not guarantee success of mG without releasing the benefits of using mG services, especially in rural areas. Net benefits are considered a critical phenomenon for the success of any IS and mG is not far from this issue. Quantitative data were collected from Iraqi citizens. Structural equation modeling was used this study to validate the findings. Results show that information, service quality and civil conflicts affect net benefits through use of mG, whereas use of mG affect net benefits of mG services. The results imply that service providers need to deliver quality information and quality service to facilitate the users' post-adoption usage of mG services.

Keywords: Civil conflicts, evaluation IS success, IS success model, mobile government, net benefits, rural areas

INTRODUCTION

In this modern era of globalisation and information technology, many governments have embraced new technologies in an effort to improve the way they offer public services to citizens. Most of the governments seek to implement projects employing highly efficient Information Systems (ISs) in their communities, spending vast amounts of money on the implementation of IS projects (Seddon *et al*., 1999). Therefore, the evaluation of the effectiveness of government IS projects is crucial, because the higher management need to justify their IT investment and evaluate whether it has an impact on users and employee performance (Alhendawi and Baharudin, 2014). Mobile technology has emerged as a new channel for communications in the public sector. Hence, many governments have attempted to exploit mobile technology to interact with citizens, businesses and agencies, employees and other stakeholders. Mobile Government (mG) is considered a highly appropriate option for countries where Internet access rates are low; however, mobile phone penetration is growing rapidly, particularly in developing countries (Faaeq *et al*., 2013). These technologies permit and enable citizens to connect with the government quickly and efficiently. Moreover, they provide timely and updated information about government services in society and to all stakeholders. Kushchu (2007) defines mG as the strategy and resource to provide citizens with information and services through a mobile platform. mG enables citizens to access information whenever and wherever possible.

Ntaliani *et al*. (2008) stated that adoption and utilisation of mG services derive more benefits in terms of in-time information delivery, ease of use, mobility

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and enhancing emergency management. They facilitate the accessibility of information 24/7 and limit the bureaucracy in order to improve the quality of services whether in terms of Ntaliani *et al*. (2008) stated that adoption and utilisation of mG services derive more benefits in terms of in-time information delivery, ease of use, mobility and enhancing emergency management. They facilitate the accessibility of information 24/7 and limit the bureaucracy in order to improve the quality of services whether in terms of time, price or convenience (Ndou, 2004). These benefits are considered as outcomes of using mG services, which indicate the success of m-government initiatives. However, all the benefits mentioned above cannot be achieved unless the use of mG services is optimal which requires the active engagement of both the government and its citizens (Accenture, 2003). The misuse may result in problems of low utilisation, dissatisfaction and the lack of net benefits. Therefore, maximum usage of mG services is considered an important element in the success of any mG project.

IS success is important for individuals and organizations. Costs, investments, profits and revenue in organizations are considered a measure for the evaluation of any IS success, whereas individuals who use IS services can evaluate IS success according to the benefits obtained after use. Delone and McLean (2003) state that net benefit is considered the main pillar of any successful IS. Net benefits are defined as a combination of organizational, individual and societal impacts, which may be influenced by IS activity (Delone and McLean, 2003).

The Iraqi government sought to utilize modern technologies in the public sector in 2003. It has invested significant amounts of money for the implementation of ICT projects, with large investments of nearly 20 billion USD annually in recent years. However, the percentage of usage of online services remain limited despite such efforts (Faaeq *et al*., 2013).

PROBLEM STATEMENT

Almost all governments in developing and developed countries attempt to harness modern technologies to enhance the service quality for citizens, government and business. Iraq is a developing country that seeks to enhance service quality through the use of modern technologies. The Iraqi government exploited wireless and mobile technologies in 2011 to provide services and information to their citizens.

The Iraqi government spends large amounts of money for the implementation of mG initiatives; however, the utilization and adoption of mG services remain low (Younus, 2014). Hameed *et al*. (2014) asserted that the use of mG services among citizens in Iraq is lower than expected, although the citizens are in dire need of these services under unstable conditions. Many researchers including Abdelghaffar and Magdy (2012), Al-Hujran (2012) and Al Thunibat *et al*. (2011) have explored the factors that affect the utilisation and adoption of mG services, however, they often overlooked or neglected important factors such as net benefits, which may have a significant impact on the utilisation of mG services (Gunasekaran *et al*., 2006; Irani, 2002). Similarly, Hosnavi and Ramezan (2010) who measured the effectiveness of a human resource information system, argued that the low usage of an IS may be an indication that the benefits have not been realised and that the citizens' expectations of such a service have not been met. Therefore, this study addresses the usage of mG services from the perspective of the net benefits of using mG services.

LITERATURE REVIEW

mG defines a strategy in which mobile and wireless technology is used to deliver services and applications to improve the benefit of an e-government (Antovski and Gusev, 2005). Recently, the rapid growth and success of mobile/wireless application and services delivered by different sectors have provided an opportunity for the government to exploit new developments and enhance electronic government implementation, thereby enabling a shift to mG systems. Such systems employ mobile devices and wireless technology to run their operations (Fasanghari and Samimi, 2009).

Furthermore, The increasing growth of ICTs has pushed the world to exploit m-technology as the next stage of the ICT revolution to improve the delivery of government services to citizens (Al-Busaidi, 2012). The rapid growth of mobile technologies compels governments to cope with this change and provide services through the new medium. Most developing and developed countries harness these technologies to deliver information and services for their citizens. The Short Message Service (SMS) broadcasting system of Mexico City, Mexico, sends alert messages to citizens in the district about meteorological and high-rain risks, low temperatures, potential disasters, emergency locations and contact numbers. Singapore's citizen alert system sends notifications for library book deadlines, passport renewals and flight information. Rwanda's eNota Project developed a mobile-based system that allows students to access their national examination results via their mobile phones. Bahrain's mobile portal, a mobile version of the national portal via WAP-equipped phones, enables anyone with a mobile phone to communicate with all government entities and access their services. India's DakNet, which is a store and forward wireless broadband network, uses a mobile access point mounted on a regular passenger bus to transmit information between village and district headquarters. The Republic of Korea provides public transportation maps of subways and buses with real-

time operation information and traffic information of main roads via mobile devices. Mobile signature is valid for signing commercial and public services and banking transactions in Turkey. Two of the country's three mobile phone operators, namely, Turkcell and Avea, offer m-signature services (ITU, 2013).

Indeed, From 1980 to 2003, Iraq faced many crises and wars, such as economic sanctions and the first and second Gulf Wars. Al-Dabbagh (2011) argues that Iraq's telecommunications infrastructure suffered significant damage because of the hardship experienced by Iraq during the last two decades. All these circumstances have stalled many governmental projects, especially the use of ISs and modern technologies (Alruwaie *et al*., 2012). Iraq initiated a reconstruction in all public sectors, especially the telecom sector, after 2003. The United Nations appealed to the international community in June 2004 to help the new Iraqi government to create the foundations of e-government (Al-Dabbagh, 2011). However, this initiative project is still not well implemented after more than 10 years since the launch.

Mobile technology emerged as a new channel for communications in the public sector in the beginning of the last century. The Internet and mobile technology have occupied a significant role in the lives of common people throughout the world. They have been recognized as the most important communication means to establish linkages between various individuals, communities, companies, organizations and stakeholders. Consequently, several governments all over the world and the governments of developing countries intend to harness modern technologies, such as wireless networks and mobile devices, to support good governance, strengthen existing relationships and build new partnerships within the civil society through the most recent ICTs (Salamat *et al*., 2011).

The mobile network infrastructure in Iraq has been strong recently. Various Internet service providers deliver services through satellites in Iraq, such as Telecom Masarat Company, Earth Link and Dejlah Internet Services. Companies, such as Korek Telecom, Asia Cell, Zain, Aumnia and Itisaluna, provide mobile cellular services (Shareef *et al*., 2010). A 2014 report by the World Bank mentioned that Iraq's mobile subscribers reached more than 25 million (Fig. 1). A survey by Younus (2014) showed that a large portion of the subscribers use smartphones. Moreover, the number of Internet users is growing at a steady rate (IWS, 2013). A 2012 report by UNESCO shows that 40 percent of mobile subscribers use the Internet through mobile cellular devices.

The Iraqi government has shown great interest and focus in the development and exploitation of ICT to make the environment conducive to new ideas (Al-Dabbagh, 2011). With modern technological advances

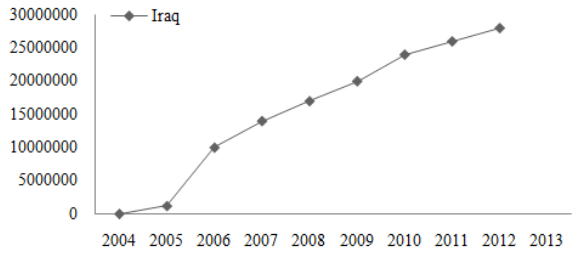

Fig. 1: Mobile phone use in Iraq (World Bank, 2014)

in 2011, the Iraqi government is exploiting wireless and mobile technologies to provide services and information to its citizens. The Iraqi government has announced the application of an mG initiative to provide e-government services via wireless communication networks and mobile devices.

mG services in Iraq were initiated with the initial mG Service (SMS) offered in the healthcare field by Messan's local government in 2011. Mohammad Khalaf Abdul Samad, the manager of the Ministry of Health's visitor program in Messan province, reported that Messan's local government in 2011 used mobile technologies by offering the initial mG service, SMS, in Iraq between government and rural residents (Qasim, 2013). The local government in Dhi Qar launched an SMS service for farmers in Dhi Qar to provide agricultural information, such as planting dates, delivery dates of crops and agricultural consulting (IMOA, 2013). The Iraqi government announced the application of mG initiative to provide citizens with services and information from institutions, such as the Iraq Mobile Weather Service (MW), National Investment Commission Application, Traffic Police Application and The Ministry of Higher Education (Hameed *et al*., 2014). Although the Iraqi government invests heavily to implement this project, the utilization and adoption of mG services remain low. Younus (2014), who conducted a survey among students in Iraqi universities, revealed that most participants do not use mG services. This finding is in agreement with (Abdelghaffar and Magdy, 2012; Al Thunibat *et al*., 2011; Mengistu *et al*., 2009), who found that many developing countries sought to implement mG projects to meet their citizens' requirements; however, these countries suffer from low use and adoption of mG services by their citizens. Therefore, realizing the benefits of mG services may increase the use and adoption of mG. This study sheds light on the net benefits, which may effect mG success among citizens.

RESEARCH MODEL AND HYPOTHESES

Information quality: DeLone and McLean (1992) defined IQ as "the quality of the information system output that the system produces, primarily in the form of reports." Information quality is considered useful if the

users view the provided information as accurate, complete, current and formatted (Nelson *et al*., 2005).

Citizens view the information quality of mG services as the quality of the content provided by these services (Delone and McLean, 2003). Citizens expect to acquire relevant information anytime and anywhere when using mG services. These services are expected to be clear, accurate, current and easy to understand and avail. Users will be dissatisfied and not avail such services again if information is inaccurate, unclear, or out of date. Searching for information is the most common reason that citizens to visit mG services. Thus, in many cases, citizens use mG services for their information needs, where they expect information to be easy to understand, clear and well formatted. Furthermore, the use of service and its information products influence the performance of users. Thus, high-quality information is an important factor use of mG services to obtain its benefits. In this study, IQ is the degree to which users believe that the quality of the information that mG service produced is accurate, complete, current and well formatted. Thus, the following hypothesis is proposed:

H1: Information quality has a significance influence on the use of mG services amongst rural farmers in Iraq.

System quality: As mentioned earlier, a significant relationship exists between IS success and benefits of an IS. According to Nelson *et al*. (2005) SYQ signifies systemized information processing required for production of these benefits. SYQ signifies the performance value of a particular system (Delone and McLean, 2003). IQ and SYQ have been recognized as the most significantly crucial quality components for the evaluation of IS success (Delone and McLean, 2003). Other studies stressed the importance of SYQ to measure IS success as well (Chatterjee *et al*., 2009; DeLone and McLean, 1992, 2003; Nelson *et al*., 2005).

In eG services, SYQ denotes citizen perception of technical performance of eG services in information retrieval and delivery (Teo *et al*., 2008). Technically, mG services offer simple and timely information accessibility along with consistent performance. SYQ plays a significantly crucial role in determining consumer use of a system (DeLone and McLean, 1992, 2003). Lee *et al*. (2007) concluded that mobile technology must be potentially capable of providing pertinent data integration and decision sustenance to improve users' use. Chatterjee *et al*. (2009) found that SYQ has a significant effect on the use of mobile technology in the m-healthcare context.

Citizens expect that mG services should efficiently provide fast and easy information retrieval and delivery, offer simple and timely information accessibility and demonstrate consistent performance. If the service is delayed in retrieving and delivering information or users cannot access information, users may revert to traditional methods to meet their needs. The researcher (Alshibly, 2014; Chen and Cheng, 2009; Chen *et al*., 2015) sees that advanced SYQ is likely to direct toward greater use, ultimately resulting in positive influence on individual productivity. In this study, SYQ refers to the quality of technical performance of the mG service in information retrieval and delivery. Therefore, the following hypothesis is proposed:

H2: System quality has a significance influence on the use of mG services amongst rural farmers in Iraq.

Service quality: According to Vanpariya and Ganguly (2010, p.6) service quality was defined as the consequential outcome of a comparative analysis between the anticipated service and its real performance. Several studies in information system investigated services quality, due to it is due to its direct linkage and importance with reference to future intention to use information system. Orgeron (2008) stated that Service quality has been designed for assessing the service received by users by measuring the difference between expectation and performance of actual service delivered by information system.

Service quality was initially incorporated in to IS success model of DeLone and McLean (2003) to measure perceptions of users toward evaluating IS success. DeLone and Mclean (2003) had emphasized that service quality has a significant influence on user Satisfaction and Intention to use/use which in turn can measure IS success. Dwivedi *et al*. (2010) argued that service quality plays a paramount role in to evaluate information system under use. Furthermore, DeLone and McLean (2003) found that service quality has a significant effect on the use of system in the context of IS success.

In this study, the researcher uses the SERVQUAL as a tool to measure service quality. Orgeron (2008) mentioned in his study that SERVQUAL is one of the commonly used tool for measuring the service quality. SERVQUAL was developed by Parasuraman *et al*. (1988) which measures five dimensions (tangibility, reliability, responsiveness, assurance and empathy). It measures the gap between the people's evaluation of expectations versus the quality of service actually received (Gilbert *et al*., 2004).

In m-Government services, many governments seek to provide high quality service to their users because they consider service quality as a critical factor for IS success (Caro and García, 2008). Service quality can significantly influence the behavior of users and has resulted in measuring the quality of mobile services as a vital medium for delivery of services in today's' fast paced and modern world (Parsons and Ryu, 2006). According to Georgescu (2010) rural farmers suffer from low service quality provided by government. As a

result, they abandon the use of those services especially in a country like Iraq which has unstable conditions (conflicts). The conflicts also affect the quality of service. For example, if service is delivered with delay, the responsiveness to help users is low, services cannot be provided anytime and anywhere, there exists no confidence between officials and users, the rural farmers will be dissatisfied and they may not use the services again. Therefore, the researcher postulates that if the rural farmer perceives that the service quality of M-government services is high, he/she is more likely to be exhibit the use of service. In this study, Service Quality (SQ) defined as the result from interaction between rural farmers and government officials and a comparison of actual performance of the service with the expected service. Based on the above discussion, the researcher proposed the following hypothesis:

H3: Service quality has a significance influence on the use of mG services amongst rural farmers in Iraq.

Civil conflicts: Conflict is an integral part of the social life in different communities and it can occur among individuals and groups as well as countries (Khan, 2010). Alarmingly high CC and violence have been recorded in recent times, particularly in developing countries including India, Iraq, the Philippines, Afghanistan, Sri Lanka and Pakistan (Heidelberg Institute for International Conflict Research (HIIK), 2008; Pedersen, 2002). The increasing number of CC is associated with the continuous struggle and fight for political supremacy to protect interests and objectives (Gershenson and Grossman, 2000; HIIK, 2008).

Political instability is recognized as a pivotal challenge faced by mG services in developing countries. It is the adoption and usage of the new technology by citizens that lead to the generation of NB out of its utilization. Sanginga *et al*. (2007) affirmed the existence of the positive relationship between CC and technology adoption. Partridge (2007) stated that the level of CC in a nation highlights its citizens' intention to use or adopt a new technology. According to Partridge (2007), the nations that are engaged in CC are expected to adopt new technologies with a considerably low degree as their main resources and that activities are focused on winning the war rather than on utilizing the latest civilian technologies. Khan (2010) also reiterated the significant relationship between CC in a nation and the technology adoption and utilization by the people of that nation. Researchers such as Fahmy and Kim (2008) and Khan *et al*. (2010a, 2010b; 2012) called for further studies of IS in different countries that are facing political conflicts. The potential effects of CC on mG services have not been sufficiently explored (Barki and Hartwick, 2001). The correlation between CC and peoples' behavior in the utilization of government services must be further evaluated and explored as a crucial matter (Khan, 2010).

CCs may create potential effects on the psychosocial and environmental aspects of the society. At the same time, little research has been conducted with respect to the effect of an unstable environment on mG success. Pedersen (2002) asserted that CC and violence generally create a substantial impact on the psychosocial life of citizens. This study focuses on the psychological effects caused by violence and CC on citizens' perception regarding the NB of using/adopting mG services in Iraq. The researcher integrated CC as the external variable to verify the effects of CC in Iraq because of the current situation and highly intensified conflicts in Iraq. Iraq is considered the world's most dangerous country because of these CC ("Top 10 Most Dangerous Countries in the World", 2013). Furthermore, most of the previous studies examined IS success in a stable environment (Alshibly, 2014; Delone and McLean, 1992; 2003; Zhou, 2013), but IS success in an unstable environment have yet to be explored (Barki and Hartwick, 2001; Yildiz, 2007). Based on the preceding discussion, the researcher proposed the following hypothesis:

H4: Civil conflict has significance influence on the use of mG services amongst rural farmers in Iraq.

Use of A system: Kim and Malhotra (2005) define "use" as the utilization of IT applications and services by individuals, groups, or organizations. In addition, Delone and McLean (2003) stated that "use" as a construct is critical to measure IS success. They also elaborated that measuring use in terms of frequency of use and usage time are good indicators of nature of usage and its effect on expected results. However, they also claimed that more use would obtain more benefits without considering the nature of this use. Accenture (2003) found that potential benefits of e-government improved service, but greater efficiency and potential cost savings would not be realized if usage of services is low. Furthermore, the use construct could play an important role in better understanding IS success. Delone and McLean (2003) explained that "user satisfaction" should follow "use" in a sequential manner.

Indeed, the use of mG services by citizens may lead to many benefits, such as mobility and ubiquity, provision of location-based government services, time savings, on-time information delivery, ease of use, weather prediction, personalized information on markets and prices and improved emergency management (Qiang *et al*., 2011). Optimal and appropriate uses of these services may bring positive

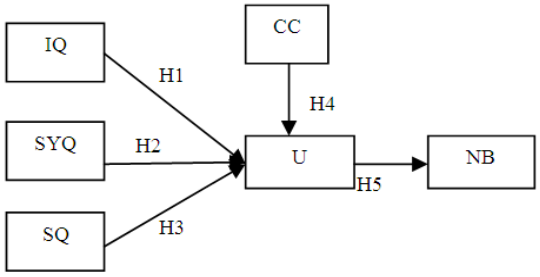

Fig. 2: Research model and hypotheses

developments in the lives of users. The researcher believes that potential benefits of mG services will not be realized if usage of the services is low. Therefore, this study defines "use of a system" (U) as utilization of mG services by individuals in terms of frequency of use, time used and number of access, which are good indicators of increasing usage and impact on expected results. On the basis of the above discussion, U is included in this research as a dependent variable that may have a positive influence on the net benefits of mG services. Therefore, the following hypothesis is proposed:

H5: The use of mG services has a significance influence on the net benefits of using mG services amongst rural farmers in Iraq.

Based on the above discussion, the proposed model includes six constructs with five main hypotheses as shown in Fig. 2.

METHODOLOGY

The Iraqi government has presented several mobile services to provide government information and services to their citizens, such as The Independent High Electoral Commission, the Iraq MW, National Investment Commission Service and Traffic Police Service. MW is most commonly used mG service in Iraq because it is closely linked with the lives of rural and urban citizens. According to a recent preliminary interview with members of staff who are working on the e-government project in Iraq, namely Laith (Systems Analyst) and Nidhal (Programmers Chief Assistant) (2013), more than 800,630 people use MW. MW was developed by the Iraqi Meteorological Organization and Seismology in cooperation with the Ministry of Agriculture to provide agricultural consultation for rural farmers through a new interface (IMOA, 2013). Therefore, the current study selected MW, which is available in all Iraqi provinces, as an example of mG services to develop the scale. This study uses citizens of the southern region of Iraq who are users of mG services. This region was selected because it is the first region in Iraq that implemented e-government services.

This study applies quantitative research methods because of the large number of respondents and wide geographical coverage. Furthermore, this study aims to investigate the interrelationship of various independent and dependent variables. In addition, this study surveys farmers who reside in the rural areas of southern region of Iraq and who are users of mG services. The sample for this study comprised 384 users of mG services. To ensure reduced margin error and potential of non-responses, the base sample size was increased (Sekaran and Bougie, 2013). Five hundred questionnaires were distributed to farmers in the southern region of Iraq. The total number of participants was 430 and 365 responses were valid.

The survey questionnaire was developed based on previous studies that reflect the constructs as identified in the research model. The research model includes seven factors. Each factor was measured with multiple items, where each item was measured on a five-point Likert scale, from strongly disagree to strongly agree. All items were adapted from extant research to improve content validity. The survey items are shown in the Appendix A.

RESULTS AND DISCUSSION

The research model was tested by using Partial Least Squares (PLS)-based Structural Equation Modeling (SEM) technique. According to the rule of thumb, the minimum sample size was 140. The sample size for this model was 384, which exceeded the minimum requirement. The results of PLS-SEM analysis are reported following the widely accepted two-step approach suggested by Chin (2010). The first step is to assess the measurement model (the outer model) for validity and reliability. The second step is to assess the structural model (the inner model) and evaluate the hypothesized relationships. The following subsections discuss the outer model and inner model in detail.

Measurement model: After drawing our model, we ran Smart-PLS 2.0 for assessing reliability and validity of the model. Reliability is evaluated by Composite Reliability (CR) and Cronbach's alpha (Bagozzi and Yi, 1988). The general acceptable threshold values are 0.60 for Cronbach's alpha (Hair *et al*., 2006) and 0.70 for CR (Bagozzi *et al*., 1998). In Table 1, all constructs had Cronbach's alpha values that exceeded 0.60 and CRs were above the threshold values of 0.70. Results indicated the reliability of all constructs in this study.

The validity of constructs is evaluated by convergent validity and discriminate validity. Convergent validity reflects the extent to which items for each construct measures the same construct. To assess convergent validity, the Average Variance Extracted (AVE) of constructs and factor loadings were used. Convergent validity is established when all

Table 1: Measurement properties of constructs

Construct	Item	loadings	T Statistics	AVE	CRs	Cronbach's Alpha
CC	CC1	0.805	31.841	0.68	0.93	0.91
	CC2	0.744	22.672			
	CC3	0.873	55.447			
	CC4	0.872	57.899			
	CC5	0.836	45.705			
	CC6	0.821	37.769			
IQ	IQ1	0.804	39.617	0.64	0.9	0.86
	IQ2	0.825	42.569			
	IQ3	0.714	18.942			
	IQ5	0.811	36.386			
	IQ8	0.838	52.084			
SQ	SQ11	0.791	29.768	0.56	0.93	0.91
	SQ12	0.8	35.656			
	SQ13	0.705	22.608			
	SQ14	0.823	45.516			
	SQ2	0.724	21.384			
	SQ3	0.784	26.968			
	SQ4	0.751	21.865			
	SQ6	0.661	16.45			
	SQ7	0.779	30.829			
	SQ9	0.629	15.39			
SYQ	SYQ1	0.801	38.988	0.58	0.87	0.82
	SYQ2	0.729	22.953			
	SYQ3	0.754	23.385			
	SYQ4	0.754	24.77			
	SYQ6	0.752	23.914			
U	U1	0.786	36.169	0.63	0.9	0.85
	U2	0.822	40.935			
	U3	0.853	50.092			
	U4	0.781	26.714			
	U5	0.729	19.347			
NB	NB1	0.736	23.575	0.56	0.88	0.84
	NB3	0.767	26.066			
	NB4	0.781	29.538			
	NB5	0.778	29.119			
	NB6	0.767	27.547			
	NB7	0.643	18.444			

Table 2: Discriminant validity values

Construct	CC	IQ	NB	SQ	SYQ	U
CC	0.83					
IQ	0.37	0.8				
NB	0.5	0.53	0.75			
SQ	0.36	0.62	0.39	0.75		
SYQ	0.36	0.68	0.44	0.66	0.76	
U	0.49	0.65	0.64	0.53	0.544	0.8

constructs have an AVE value greater than 0.50 (Fornell and Larcker, 1981). In Table 1, all AVE values are above 0.50, thereby confirming the convergent validity of constructs. The absolute standardized outer loadings of items ranged from 0.62 to 0.87. Chin (1998) claims that loadings of more than 0.5 could still be acceptable if other indicators exist in the block for comparison. All items are significant at 0.001. Therefore, the convergent validity of the constructs is confirmed.

Discriminant validity reflects the extent to which constructs are significantly different from each other. Discriminant validity is established when indicator loadings on their measured constructs are all higher than cross-loadings on other constructs and the square root of each construct AVE is larger than its correlations with other constructs (Chin, 1998).

The first step in assessing discriminant validity is to examine the indicator loadings with respect to all construct correlations. SmartPLS algorithm function was used to produce cross-loadings of all items. In Appendix B, all items loaded on their constructs were higher than cross-loadings on other constructs. Therefore, the first assessment of the measurement model's discriminant validity was satisfied.

In the second step, the square root of the AVE of each construct was compared with the correlation between that construct and the other constructs. In Table 2, the square root of the AVE exceeded the highest correlation between that construct and the other constructs, thereby further proving discriminant validity (Chin, 1998; Fornell and Larcker, 1981).

Table 3: Results of hypotheses testing

HYP. No.	Hypothesis	Path coefficient	Standard error	T statistics	p-value
H1	CC->U	0.218	0.050	4.388***	<0.01
H2	IQ->U	0.351	0.060	5.896***	<0.01
H3	SYQ->U	0.041	0.058	0.702	0.480
H4	SQ ->U	0.058	0.080	0.721	0.470
H5	U->NB	0.484	0.065	7.496***	<0.01

1.65 (*P < 0.10), 1.96 (**P < 0.05), 2.58 (***P< 0.01)

Structure model: After assessing the measurement model for reliability and validity, the next step is the assessment of the structural model. Bootstrapping was used to test the structural model and hypotheses (Hair Jr *et al*., 2014). Approximately 1,000 resamples were used to perform the bootstrap (Chin, 1998). The evaluation of the structural model was investigated after establishing the appropriateness of measures in the research model. PLS-SEM does not have standard goodness-of-fit statistics and prior efforts to establish a corresponding statistic have proven highly problematic (Henseler and Sarstedt, 2013). Instead, model quality is assessed based on its ability to predict endogenous constructs. This assessment is facilitated by the following criteria: coefficient of determination (R2) and path coefficients. Therefore, this study applied PLS algorithm-style approach to obtain the R2 for primary and secondary endogenous variables. Bootstrapping technique was used to obtain the significances of all path coefficients between exogenous (dependence) and endogenous (independence) variables.

We assessed the predictive power of the model. The value of R2 is the main criterion by which model fit is assessed in PLS analysis (Chin, 1998). The value of R2 is normalized between 0 and 1, where a higher value represents better path model estimations. R2 of endogenous constructs are 0.55 and 0.45 for U and NB, respectively.

To test the proposed hypotheses, the path coefficient between latent variables and their significance was assessed. After running a PLS model, estimates were provided for the path coefficients, which represented hypothesized relationships linking latent constructs. To test the main hypothesis, the bootstrap approach was used to assess the significance of hypothesized relationships in the path model. In the current study, 1,000 resamples were used to perform the bootstrap (Chin, 1998). The number of bootstrap cases equaled the original number of observations to generate standard errors and obtain t-statistics. In Table 3, the t-statistics indicated that all path coefficients are significant (T statistic>1.96), except for H3 and H4.

DISCUSSION

The results obtained from the analysis of our model are showed in Table 3. CC and IQ have significant effects on U, but SYQ and SQ have no effect on U, while U predicted net benefits.

The statistical results indicated that CC has a significant effect on U (0.218, t = 4.388, p<0.01); therefore, H1 is supported. The finding suggests that an unstable environment has a significant effect on the use of mG services amongst rural residents. These results are expected since Iraqi citizens cannot live normal lives while they are subjected to such an unstable environment. In other words, in an unstable environment, the outbreak of civil conflicts, explosions, kidnappings and car bombs can cause the local or central government to enforce a curfew. A curfew prohibits citizens from leaving their homes or local areas, thus, users cannot go outside their areas to carry out their transactions, such as selling their crops, consultation with experts, or travel to any government departments, which are typically very far from their areas. Another reason is that, due to the very long period of conflict, from 2003 until now (2015) and probably further into the future, Iraqi citizens are looking for alternative methods to practise their lives (Faaeq, 2014). Therefore, in this situation (curfew), the results indicate that the use of mG services is the optimum method of completing their transactions and meeting their requirements. It implies that the use mG services had increased in an unstable environment such as Iraq. Therefore, the risky conditions and level of security impact the use of mG services amongst Iraqi citizens. In examining the hypothesis H2, the results imply that IQ has a considerable impact on U at the 0.01 level of significance (β = 0.351, t = 5.896, p<0.01). The finding suggests that individual use of the mG service can be improved when the quality of information is high. The result implies that the farmers in the rural areas of a southern region of Iraq would have had positive behaviors towards the usage of mG services when they found they could obtain accurate, easy to understand, clear and up-to-date information to conduct Mobile Weather Service (MWS) at any time and from any location. If this information is inaccurate or out-of-date, users may feel annoyed and that they have a lack of control. This will undermine their usage. In addition, it is relatively difficult for users to search for information on mobiles due to the screen size. Therefore, the ability to obtain information directly without having to exert any effort to search would increase the rate of use and reuse of this service. Thus, MW staff should present accurate, easy to understand, clear and up-to-date information to their users. This may help improve the usage rates of farmers. Indeed, individual use of mG services can be increased when the quality of information is improved. The implication of this is that information which is high quality can greatly encourage the public to engage with it, which consequently increases the net benefits of mG services. This result (H2) corresponds to the results of previous empirical studies which have provided empirical

evidence of the significant positive effect of IQ on U (Alshibly, 2014; Bento and Costa, 2013). Consequently, our result for H2 is better than some previous works, with $\beta = 0.3513$, comparing with Alshibly (2014), who generated results of $\beta = 0.32$ and 0.24 respectively.

In examining the hypothesis regarding the effect of SYQ on U results, it was determined that SYQ has no effect on U ($\beta = 0.041$, $t = 0.702$, $p>0.1$). Unexpectedly, this finding did not support H3 at the positive significant effect hypothesized. There are several reasons for this outcome. Firstly, due to the instability in Iraq as a result of civil conflicts, typically electric power is unstable. Power outages in either the service providers' department or in mobile networks cause difficulties with the accessibility and availability of the service. Secondly, the mG system functions on one or more of mobile phone systems (Android, Apple IOS), which the user may not be familiar with. Previous empirical studies recommended that SYQ should play a critical role in the success IS. Conversely, SYQ may be a necessary condition, but it is not the sufficient criterion to motivate users to choose mG services in conflicts and risky environments. This result (H3) is in line with other studies such as Urbach *et al*. (2010) and Dwivedi *et al*. (2013), who achieved outcomes of $\beta = -0.109$ and $\beta = 0.05$, respectively.

In examining the hypothesis related to the effect of SQ on U results, it was found that SQ has no effect on U ($\beta = 0.058$, 0.721, $p>0.1$). The reasons behind this result are that firstly, Iraq is an unstable environment, with a history of civil conflicts, which sometimes leads to unstable electric power. When these power outages affect the service providers' departments or mobile networks, accessibility is severely compromised for long periods, leading to a lack of trust in the service. Secondly, it is possible that the actual performance of the service is not compatible with their expectations. Moreover, this result can also stem from late replies by the service in times of need. According to farmers in FA in Nasria, they have experienced either late replies, or no replies at all from the staff of the service. This result (H4) is in line with other studies, such as Urbach *et al*. (2010) and Dwivedi *et al*. (2013), who achieved results of $\beta = -0.018$ and $\beta = 0.0$ respectively.

In examining the hypothesis related to the relationship between U and NB, the results imply that the effect of U on the NB has a strong impact at the 0.01 level of significance ($\beta = 0.484$, $t = 7.496$, $p<0.01$). Therefore, H5 is supported. This would indicate that for users in rural areas, frequency of use of mG services increases positive user behavior, thus increasing the benefits received. Moreover, the results also reveal that appropriate use of these services brings positive developments in the lives of rural farmers. For example, when a farmer achieves a level of comfort with accessing the service, experience levels increase, thus resulting in more benefits being gained through use of the service (such as productivity, job performance, time and cost efficiencies, on-time notifications of emergency situations and weather status). During the data collection phase, the respondents conveyed that an unstable environment where civil conflicts, violence and many explosions occur, citizens are prevented from performing their work, which leads to a significant increase in the use of mG services remotely in order to obtain the associated benefits. Moreover, the supported result in hypothesis H5 is compatible with previous studies indicating that U influences the NB (Khayun and Ractham, 2011; Urbach *et al*., 2010; Wang and Liao, 2008; Yim and Shin, 2014). Consequently, the result of H5 outweighs several of the related studies' results on the effect of U on the NB, such as Wang and Liao (2008) and Khayun and Ractham (2011), with results of 0.36, 0.30 and 0.219 respectively.

CONCLUSION

Acquiring net benefits is critical to the success of any IS. These benefits ensure that users are retained and facilitate their usage of mG services. These possible benefits will not be achieved if the use of these services is not optimal. Results indicated that IQ and CC affect NB through U; and U affected the NB. Results imply that service providers need to deliver high-quality information to facilitate post-adoption usage of mG services. Indeed, individual use of mG services can be increased when the quality of information is improved. The implication of this is that information which is high quality can greatly encourage the public to engage with it, which consequently increases the net benefits of mG services. Results also imply that the use mG services had increased in an unstable environment such as Iraq. Therefore, the risky conditions and level of security impact the use of mG services amongst Iraqi citizens.

This study has some limitations. First, this study was conducted in the southern region of Iraq. Whether these results could be generalized to other regions of Iraq, such as the middle and northern regions, needs further research. In addition, mG in Iraq is developing rapidly but is still in its early stage. Thus, results need to be generalized to other countries that have developed mG. Second, aside from "use" construct, other factors could affect net benefits, such as satisfaction, trust, security and environment of usage. Future research can examine the effects of these factors. Third, this study is cross-sectional and user behavior is dynamic. A longitudinal research may provide more insights into user behavior development. This phenomenon is considered new in Iraqi society. Therefore, more studies, whether empirical or theoretical, are needed for comprehensive understanding of factors that impede the use of mG in the public sector.

This study will be a useful resource for both the Iraqi central government and local governments to help the high officials and professionals who are strategic

policy-makers to better understand the citizens' concerns especially in places where there is persistent violence and conflict. Moreover, this study is useful for the government in identifying the significant factors that could impact on the success of mG systems, which can help the government to move forward with the delivery of more efficient and superior quality mG services.

Appendix A: Sources and measurement of constructs

Constructs	Items	Sournces
Information quality	• Through MW, I get the information I need in time. • Information provided by MWS meets my needs. • Information provided by MWS is in a useful format. • Information provided by MWS is clear. • Information provided by MWS is easy to understand. • I am satisfied with the accuracy of information by MWS. • MWS provides me accurate information. • MWS provides the most current information. • MWS provides me with up-to-date information. • Overall, the MWS provides me with high-quality information.	Chen and Cheng (2009), Chen *et al*. (2015), Delone and McLean (2003) and Teo *et al*. (2008)
System quality	• MWS performs reliably and securely. • MWS operates smoothly without errors. • MWS can be accessed immediately. • MWS quickly loads all the text and graphics. • MWS provides high-speed information access. • MWS can be adapted to meet a variety of needs. • MWS is easy to use. • MWS is easy to navigate. • MWS is user friendly. • Overall, in terms of system quality, I would rate the MWS highly.	Alshibly (2014), Chen and Cheng (2009), Chen *et al*. (2015), Delone and McLean (2003), El-Kiki and Lawrence (2006) and Zhou (2013)
Service quality	• When I have a problem, the MWS shows a sincere interest in solving it. • MWS provides on-time services it promises. • MWS is dependable. • MWS provides prompt responses • MWS is responsive to farmer's request. • MWS responds quickly to my needs. • The behavior of MWS helpdesk instils confidence in me. • MWS provides professional services. • MWS helpdesk have the knowledge to do their job well. • I feel safe when I use the MWS. • MWS helpdesk gives me individual attention. • The MWS helpdesk has my best interest at heart. • The MWS helpdesk understands my needs. • Overall, I rate the quality of service provided by MWS highly.	Alshibly (2014), Chen and Cheng (2009), Chen *et al*. (2015), Delone and McLean (2003), Teo *et al*. (2008), Chien (2004) and Zhou (2013)
Civil conflicts	• Latent conflict: There are clear differences in the positions regarding objectives between individuals and groups around me, which deter me from using MWS. • There are continuous conflicts (unmanifested) around me, which deter me from using MWS. • Verbal threats and abuse can be heard around me, which deter me from using MWS. • Crises: There are manifest conflicts between Individuals/groups around me, which deter me from using MWS. • Severe Crises: There are severe conflicts around me, which deter me from using MWS. • Strong conflicts: Strong conflicts generate crises around me, which deter me from using MWS.	Faaeq (2014) and Khan *et al*. (2010a, 2010b)
Net benefits	• Using the MWS in my job enables me to accomplish works more quickly. • MWS improves my job performance. • Using the MWS in my work increases my productivity. • MWS improves my income level. • MWS saves my time and money. • MWS increases knowledge as a result of the exchange information. • MWS Establishes and maintains a good image and reputation for me. • MWS Satisfies my requirements	Delone and McLean (2003), Iivari (2005), Teo *et al*. (2008) and Chien (2004)

Appendix A: Continue

Use of a system	• How many times do you use MWS Month? About once [1] 2 or 4 times [2] 5 or 7 times [3] Not at all [4] more than 8 times [5] • . How many days do you visit MWS during a Month? Less than 1 day [1] 2–5 days [2] 6-9 days [3] Not at all [4] Greater than 9 days [5] • How many hours do you use MWS Month? Less than 1 hour [1] 1–2 hours [2] 3–4 hours [3] 4-5 hours [4] Greater than 5 hours [5] • How much time do you spend with the MWS during the ordinary day when you use mobile device? Less than 1/2 hour [1] 1/2–1 hours [2] 1–2 hours [3] 2–3 hours [4] Greater than 3 hours [5] • How frequent do you use MWS ? Very irregular [1] irregular [2] Neither [3] regular [4] Very regular [5]	Abdulwahab and Dahalin (2011) and Delone and McLean (2003)

*MWS: Mobile Weather Service

Appendix B: Cross loading criterion

Constructs/Items	CC	CIO	IDQ	IQ	NB	SQ	SYQ	U	US
CC1	0.805	0.206	0.278	0.353	0.461	0.397	0.378	0.463	0.417
CC2	0.744	0.187	0.185	0.252	0.315	0.276	0.220	0.338	0.297
CC3	0.873	0.156	0.199	0.247	0.409	0.292	0.246	0.372	0.288
CC4	0.872	0.209	0.259	0.294	0.445	0.280	0.301	0.412	0.331
CC5	0.836	0.171	0.253	0.320	0.408	0.258	0.313	0.371	0.295
CC6	0.821	0.176	0.241	0.361	0.396	0.250	0.296	0.431	0.346
IQ1	0.284	0.219	0.266	0.804	0.430	0.461	0.531	0.482	0.497
IQ2	0.322	0.277	0.328	0.825	0.439	0.500	0.497	0.532	0.463
IQ3	0.268	0.394	0.318	0.714	0.337	0.542	0.524	0.447	0.481
IQ5	0.321	0.316	0.364	0.811	0.452	0.448	0.483	0.555	0.487
IQ8	0.295	0.284	0.281	0.838	0.462	0.528	0.655	0.581	0.528
NB1	0.364	0.336	0.402	0.452	0.736	0.355	0.399	0.499	0.540
NB3	0.362	0.205	0.236	0.353	0.767	0.289	0.283	0.453	0.384
NB4	0.413	0.133	0.288	0.354	0.781	0.300	0.300	0.501	0.382
NB5	0.385	0.109	0.198	0.463	0.778	0.348	0.382	0.489	0.397
NB6	0.363	0.182	0.257	0.390	0.767	0.218	0.314	0.500	0.416
NB7	0.330	0.139	0.211	0.363	0.643	0.197	0.267	0.401	0.301
SQ11	0.317	0.322	0.353	0.455	0.293	0.791	0.506	0.419	0.475
SQ12	0.342	0.382	0.362	0.516	0.301	0.800	0.514	0.483	0.519
SQ13	0.326	0.348	0.408	0.485	0.359	0.705	0.484	0.476	0.476
SQ14	0.275	0.321	0.332	0.553	0.290	0.823	0.534	0.403	0.483
SQ2	0.246	0.371	0.366	0.479	0.293	0.724	0.542	0.376	0.539
SQ3	0.224	0.235	0.237	0.424	0.210	0.784	0.473	0.379	0.458
SQ4	0.262	0.185	0.214	0.432	0.226	0.751	0.457	0.374	0.340
SQ6	0.155	0.183	0.153	0.461	0.254	0.661	0.574	0.336	0.310
SQ7	0.281	0.289	0.313	0.416	0.350	0.779	0.438	0.370	0.462
SQ9	0.179	0.169	0.184	0.380	0.291	0.629	0.386	0.303	0.291
SYQ1	0.310	0.343	0.354	0.512	0.347	0.513	0.801	0.441	0.522
SYQ2	0.328	0.336	0.285	0.418	0.344	0.435	0.729	0.400	0.396
SYQ3	0.235	0.254	0.265	0.561	0.312	0.417	0.754	0.377	0.399
SYQ4	0.234	0.232	0.181	0.481	0.338	0.481	0.754	0.399	0.424
SYQ6	0.254	0.299	0.250	0.585	0.321	0.626	0.752	0.439	0.473
U1	0.363	0.201	0.309	0.569	0.513	0.476	0.468	0.786	0.478
U2	0.421	0.243	0.395	0.536	0.508	0.452	0.415	0.822	0.488
U3	0.433	0.269	0.366	0.560	0.557	0.467	0.397	0.853	0.537
U4	0.340	0.228	0.350	0.427	0.512	0.365	0.433	0.781	0.502
U5	0.375	0.245	0.278	0.495	0.441	0.341	0.459	0.729	0.445

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