Technology Acceptance of Mobile Health Application in GCC Countries: Case of Kuwait

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***Abstract*—** e-health solutions have the potentials to bring many opportunities to the GCC countries including Kuwait. E- Health solutions have proven quality of healthcare delivery and services in the industrialized countries. This paper describes a pilot study to present the unbiased empirical evaluation of stakeholder's towards e-health delivery solutions and services in Kuwait. In an effort to catch up with the growth, the developing countries have strived to revolutionize the healthcare industry by the uses of innovative solutions including mobile computing to educate stakeholders to remain healthy and receive a customized health service. The issues examined include the application of TAM model and Q method frameworks to better understand both negative and positive views of stakeholders' adoption factors. The present research indicated that the perceived security risk was the least obstacle. Accordingly usefulness and ease of use domains are the most apparent significant elements for the escalating embracing of mobile health application in Kuwait. Consequently, the data analysis produced two factors labeled as "technology readiness" competent and "risk insensitive" stakeholders.

Keywords*— *Electronic Health, Q method, Technology Acceptance Model, Mobile Health Applications, Kuwait

I. INTRODUCTION

The healthcare industry is endeavoring to reduce expenditure, disregard the legal accountability for medical errors and upsurge productivity. In addition, this specific sector has been experiencing rising challenges in countries around the globe, apparently more in developing countries including Kuwait. This has exerted the pressure on IT professional to find the most effective combination of new technology and e-health solutions to improve the delivery of health services and better informed stakeholderss [5] [20] [13] [14]. it is essential to note that this complex sector is an information-intensive environment and the only single promising solution to present challenges is to make greater utilizing of mobile health applications as optimal approach to re-engineering the healthcare sector [7] [20] [28].

Another promising solution in this specific domain is the application of mobile health computing (known as m-health) and interactive technologies and e-health to solve the limited capacity of the healthcare problems and nurturing productivity.

The government expenditures on healthcare domain are expected to reach seventy one billion dollars by the year 2020 in GCC countries. In the meantime, Kuwait makes up around 11 percent of all total project monetary values spent in the GCC. A continued inexpensive oil price milieu may largely impact the financial planning amongst GCC governments and, hence, the healthcare expenditure. Furthermore, a growing population composition, aging demographics measures, lifestyle illness, and medical domain has led government initiatives to focus the attention and budget to provide quality of healthcare services to fuel the growth in the healthcare sector. Due to scarcity of research on e-health applications and e-health solutions in the Middle East region, particularly, Kuwait, this paper sought to explore attitudes and perceptions to m-health applications and e-health domains [1] [15] [27] [10].

The current study recognizes that the precise nature of the impact of e-health infrastructure and its solutions on healthcare reform could be substantial or even revolutionary. It also recognizes the variety of uses of stakeholders including medical practitioners, informal and formal healthcare providers, healthcare staff, students, patients and interested members of society in Kuwait. Furthermore, there may be numerous needs sprouting around e-health and mobile health applications. Moreover, it is essential to understand the issue from different breadth and depth of information required by different groups of stakeholders that might lead to more effective and efficient health outcomes.

This study is an exploratory research that intends to understand the variety of requirements and provide insights of possible stakeholders of e-health solutions including mobile applications. Because of the complexity of this phenomenon a Q method was utilized to identify a variety of views and subjective experiences for the e-health and its mobile health applications. The approach of Q method facilitates the way in dealing with subjective views with the use of quantitative techniques for data categorization and factor analysis [8] [29].

II. LITERATURE REVIEW

There is a poor adoption of technology among health applications in Kuwait despite the positive vibe that technology can mend the quality of healthcare. For this reason, this study sets to explore the trend of mobile health applications implementation of Technology Acceptance Model (TAM) and Q method.

The best well-known theoretical model that explains how stakeholders come to accept and use a new technology is TAM model. This model integrates the diffusion innovation theory to better explain the new needs of stakeholders of new technology tools or other channel of health communication and the factors that might influence the stakeholders' decisions [12] [25] [18]. Ultimately, the success of health communication interventions and innovations via electronic

channels is reliant on the utilization of technology by the target stakeholders for envisioned needs.

Davis's (1989) TAM model based on stakeholders' perceived usefulness (PU) and Perceived ease of use (PEU) of the technology for a specific purpose. Moreover, PU defined as "the degree to which a person believes that using a particular system would enhance his or her job performance" [12]. Davis (1989) defined PEU as: "the degree to which a person believes that using a particular system would be free of effort" (p. 320) [12]. One may imply that stakeholders intend to use the new electronic health channels to enhance their job (or goal) performance and health outcome goals [12]. The PEU dimension might give incentives for stakeholders as it is the easiest way of communication in healthcare setting. Furthermore, the validity and reliability were established by including six items to measure each PU and PEU respectively.

A new modified Tam model incorporates Subjective Norm (SN) or social influence (peer pressure from colleagues, bosses and significant others) to define the opinions of different stakeholders of health technology tools. The intention to use any types of health information technology is through social pressure perceived social pressure. To better capture the subjective views of health information technology, an innovative research method is used here known as a Q method.

Several strands of studies applied TAM's models to investigate the adoption of technology in the workplace with regard to the new technology. Another healthcare pipeline was added to strand to include perception of health technology tools used by physicians, nurses, and clinicians [16] [31] [24] [26]. Another vibes include electronic health records (EHR) and Health Information Technology (HIT) was added to past research [6]. Moreover, similar studies evaluated the application of HIT including personal digital assistants, radiological image archiving and communication systems and telemedicine technology.

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A related strand of literature focused on health stakeholders' behaviors and their adoption of medical technologies. Another study integrated TAM model with motivational theory which resulted in an extended model that linked PU and PEU with external motivational elements [11] [32].

Similarly, TAM model has been commonly used as effective method to measure stakeholders' approval of technologies in any economic sectors inclusive of m-health, e-health and telemedicine research [23]. Another recent study applies TAM in a more stakeholder's health informatics setting [17]. To test reliability and validity issues for both scales, Davis (1989) confirmed the Cronbach alpha reliabilities of this instrument were high for both PU (. 98) and PEU (. 94). Significant correlations with health use were found for PU ($r = .85$, $p < .001$) and PEU ($r = .59$, $p < .001$). Both PU and PU were found to be highly reliable ($\alpha = 0.96$ and 0.91, respectively) [12].

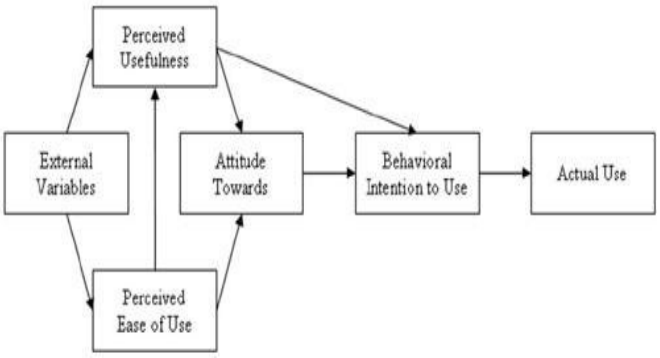

Figure 1: The Original TAM [12]

Perceived behavioral control (PBC) was derived from the theory of reasoned action and theory of planned behavior that link between behavior, beliefs and attitudes. Together this domain shapes an individual's behavioral intentions and behaviors [19]. PBC defined as the extent to which one has control over the outcome. Another important variable to consider when measuring the intention to use information technology is through the system which is done in this study thru taking into the account perceived security measure. How secure the M-health systems in terms of e-health environments are.

Generally, factors associated with behavioral intention to exploit any type of technology could be grouped into four contexts: individual context, system context, social context, and organizational context. While social context means social influence on personal acceptance of technology, organizational context highlights any organization's influence or support on one uses of technology. Thong, Hong, and Tam (2002) identified relevance, system visibility, and system accessibility as organizational context variables. They reported that the organizational context affects both perceived usefulness and perceived ease of use of a digital library [30]. Another study reported that higher information accessibility brings about higher use of technology as well as a higher perception of ease of use in terms of e-learning accessibility as an organizational factor [21].

To sum-up, based on the previous research, variables related to adoption and acceptance behavior come from four sources: Individual, System, Social pressure, and organizational sources. To explore an individual attitude is done via two main indicators: one cognitive constructs and the other is behavioral constructs. For this important purpose, this study applies TAM ways to measure cognitive constructs by using PU, PEU and PBC dimensions, whereas SN is used to measure subjective intention to use M-health and e-health.

I. RESEARCH DESIGN

A. Q method

Q method is a widely used approach in numerous research fields [2] [3] [4]. It is developed mainly to examine stakeholders' perceptions and attitudes [29]. In general, the topic under investigation are presented to stakeholders (this is known as a Q-set) from which they are rank their preferences and in so doing reveal their perceptions [8]. The stakeholders' perception then undertakes factor analysis. In this way it is possible to identify significant clusters of correlations that can be described as common perception [9].

B. Concourse Stage

In the present study, the stakeholders' opinions of m-health applications extracted from various medical practitioners, medical students at Kuwait University. In the first phase, a concourse [29] was held where a representative group of stakeholders were encouraged to produce as many statements as they could on m-health applications based on their experience and knowledge. A concourse, that collects all the views and opinions (not facts) on the subject at hand, provides the raw material for setting up a Q study [22]. Once all the statements are collected and reviewed. In addition to statements collected during the concourse stage, statements were also obtained by the researchers from secondary sources in the literature. In all, a total of 50 items made up the final set of statements, which is known as the Q-sample.

C. Sorting Stage

In the second phase of a Q method, stakeholders were asked to sort the refined statements based on their personal preferences. Unlike the concourse, the Q-sort is conducted on an individual basis. This Q-sort involved a group of relevant potential stakeholders of m-health applications in Kuwait, and was composed of medical practitioners, medical students, other university students, academics, and society, most of who were involved in the concourse.

D. Q-Sample

Under the instruction of the researcher, stakeholders are then asked to make an initial reading through of the Q-sort to get the impression of the range of opinions on a health issue. At the same time, the stakeholders are asked to sort the collected statements into roughly three equal main categories: those statements selected to be positive statements, neutral, and negative based on their perception of the statement on the practice of using health knowledge source. The next step in sorting was to ask stakeholders to focus on the first sets of statements then they reread that category, carefully select the one they considered most important, and places its corresponding number under the +5 column on the Q sort scale as in the figures below (see Figures 2 and 3). Then the stakeholders continue until all of the comments in the first categories have been placed on the data sheet (Q-grid) [16].

A similar process occurs for the remaining category with activities that are judged less important (rarely performed) being placed in the -5,-4,-3, and -2 category and the remaining activities filling in the middle columns of the inverted pyramid on the datasheet. The consequence of the sorting process is a forced decision making process, where the stakeholders must decide amongst the statements and produce a result that reflects their decisions.

In the present study 30 stakeholders successfully sorted the 50 statements that covered elements they would want on a health mobile application. The stakeholders took, on average one hour to complete the sort with many respondents, such as nurses, general practitioners, medical students in Kuwait, taking time away from their duties to do so. The majority of stakeholders were male (nearly 60 % males). Their ages ranged from 21 to 50 years. There were 40% female stakeholders and their ages ranged from 21 to 55 years. Each participant was given a Q-sample as a set of 50 numbered cards on which the statements were written. They were required to make choices on the statements by sorting them from most agree (+5) to most disagree (-5). A demographic section was also provided to collect basic information about the stakeholders, see figures 2 and 3 for 50 statements presented in the appendix section.

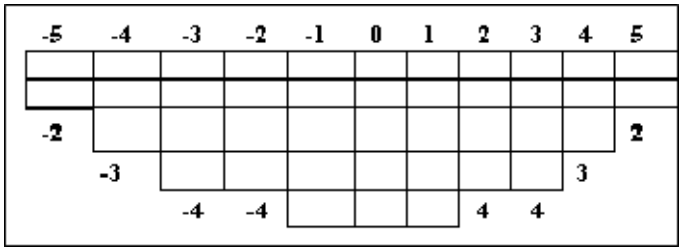

Fig. 2. Q-Sort Scale (Q-Grid)

Thus, the stakeholders sorted the statements on a Q-sort scale ranging from most agree (+5) to most disagree (-5). The sort distribution is showing in the following figure (3):

	Most disagree					Neutral					Most agree
Score	5	4	3	2	1	0	1	2	3	4	5
Frequency	2	3	4	6	6	8	6	6	4	3	2

Fig.3. Q-Sort Distribution

II. DISCUSSION OF RESULTS

The stakholders' perceptions were examined to explore and identify factors analysis [29]. In this study, a two factor solution was selected for the interpretation of the data as it has a high number of sorts (p-set), a low level of confounded sorts and low level of insignificant sorts. The 2-factor was defined by 22 stakeholders (73%), whereas eight stakeholders did not load significantly on any of the factors. The 2-factors account for 36% of the variance in Q-sorts. The socio-demographic characteristics are shown in Table 2. The 2 Factors are now labeled as "technology readiness" competent and "risk insensitive" stakeholders.

Fifteen stakeholders loaded significantly onto Factor-1. Table 4a and Table 4b contain the significant statements loaded into Factor 1. Eight males and seven females; 12 singles and 2 married, 10 holders of undergraduate degrees aged 18-24 years old. The Factor includes level of agreements and disagreements. There are twelve (12) statements describing the types of p-sample views which explained by the Z-scores. The Z-score is used as the criterion of selecting these statements. This Factor sees the practical service benefits that e-health and m-health applications may bring to all stakeholders in Kuwait, including patients, patient advocates and healthcare providers as in statements (12, 15, 14, 25, and 42). The measures of PU and PEU are effectively shown in statements (7, 13, 18, and 24). Only statement 45 shows that this factor believes that they might have a substantial behavioral control. This implies that this factor is technology confident and competent. Therefore, this factor is labeled as "technology readiness" to adopt innovations in e- health.

Table 4a: Factor -1 'Strongly Agree' Significant Loadings Statements

No.	*Statements*	*Z-scores*
7	Easy to do tasks with m-health applications	1.99
46	I trust m-health applications	1.89
12	The m-health applications supports critical aspects of my health care	1.682
15	The m-health enables better decisions based on better evidence- based environment	1.582
45	The m-health system is convenient for me	1.389
14	The m-health improves patient care and management	1.224
13	It is easy to become skillful with m-health system	1.215
18	It does not demand much care and attention	1.138
21	The m-health is useful for job (or task)	1.105
24	The m-health is flexible to use/interact with	1.062
25	The m-health increases quality of care	1.022
42	I'm able to use m-health system for patient care and management	0.998

The nine statements in Table 4b expand this view further by listing the main statements with which the stakeholders on Factor 1 strongly disagree. They were not concerned with social factors and subjective norms that influence their choice of mobile applications as shows in statements (33, 28, 36, and 30). This implies that there is a lack of social support to encourage the use of m-health apps in Kuwait. That might be a cause of the limited number of m-health apps stakeholders in Kuwait. The statements 1, 2, 3, 22, 39- are indications of the reasons for lack of social support, including perceived benefits of healthcare providers' productivity and job effectiveness.

Table 4b: Factor -1 "Strongly Disagree" Loadings Statements

No.	*Statements*	*Z-scores*
33	Senior management of the hospital has been helpful	-1.523
28	My family doctor who influences my behavior think I should use M-health system	-1.469
36	Subordinates at work think I should use M-health system	-1.315
22	The m-health requires low mental effort	-1.252
39	The m-health system is compatible with other systems	-1.214
30	Stakeholders whose opinions I value think I should use m-health system	-1.176
3	The m-health enhances effectiveness of job (or work)	-1.130
2	The m-health is useful for job (or task)	-1.104
1	The m-health increases my productivity	-0.968

Factor 1 consists of 7 stakeholders. Table 5a and Table 5b contain the significant statements loaded into Factor 2. The strongly agreed statements in Table 5a imply that the stakeholders in Factor 2 recognize the importance of risk and trust issues (No. 47, 48, and 50) whereas, this factor still gives weight to PU and PEU Domains as reflected in statements 16,17,7. Therefore, this factor is labeled as "risk insensitive" group. On the other hand, from the strongly disagreed statement in Table 5b, this group in Factor 2 does not have concerns around privacy issues as reflected in statement 49. The stakeholders on this Factor also do not seek technical assistance and knowledge to use their M-health apps (statements 40, 38). It is also worth noting that this Factor dislike the social influence (statements 29, 34).

Table 5a: Factor-2 'Strongly Agree' Loadings Statements

No.	*Statements*	*Z-scores*
47	I trust that my health information remains confidential with m-health apps	1.201
16	The m-health is clear and understandable	1.11
48	I trust that my health information remains confidential with m-health apps	1.098
7	The m-health increases quality of care	0.942
17	The m-health applications are easy to use	0.888

50	I trust the m-health technology to be free of risk	0.847

Table 5b: Factor -2 'Strongly Agree' Loadings Statements

No.	*Statements*	*Z-scores*
40	There is a availability of technical assistance	-1.453
38	I have the knowledge to use m-health system	-1.105
29	Stakeholders who are important to me think I should use m-health system	-1.098
34	Who is important to me thinking I should use m-health system?	-0.957
49	I have no privacy concerns using m-health apps	-0.786

III. CONCLUSIONS& RECOMMENDATIONS

In this paper, TAM provides future potential capability addressing serval perception of stakeholders towards e-health solutions in terms of m-health applications within healthcare sector in Kuwait. For this purpose, the present study successfully identified the salient range of views and attitudes that clinicians have about using e-health applications as an e-health solutions. It was contextualized TAM to healthcare to show that there is the opportunity to develop and uncovers the specific and, importantly, actionable meaning and causes of generic variables such as the usefulness and ease of use, helps determine who are the "significant others" of subjective norms and what are the actual barriers and facilitators to m-health use. The present paper focused on factors perceived to impinge on effective use of m-health applications as e-health solutions in Kuwait. The present study provides a systematic review of subjective attitudes which has demonstrated that e-health solutions offer a modern measure to meet both current and future challenges of healthcare domains. Overall, there is a strong evidence to support the m-health applications technologies in domains of its usefulness and ease of use. Meantime, there was an apparent evidence for a weak social support for its implementations which could explain its impediments and being the least demanded in the market of Kuwait and among its growing populations in terms of their demands and needs. However, as the security and privacy issues remained minimal of various groups, stakeholders appreciate the optimal benefits of technical innovations. This suggests that the various stakeholders in Kuwait are ready to adopt technological innovations and m-health applications.

However, the progress towards developing m-health applications is under structured and at the quiet early stage of planning of healthcare strategies and implementation of health promotion-related e-health tools. The pressure will highly be likely to push the progress in the future of healthcare that requires intensified co-operation and networking of stakeholder which is still in its infancy stage. Another finding is that the ambiguous understandings among the participants on how a mobile health app should looks like. The main ideas of participants given for the purpose of the m-health app would be similar to hotel and/or airline reservation system commonly used in Kuwait. The participants also pointed to the importance of governmental role to monitor the increasing medical errors and impose national policy to safeguard the healthcare practices. To reduce such medical errors, the government needs to consider a future strategy input through the use of artificial intelligence system.

In this paper, the results indicated that there was not any significant trends on the levels of education and professions of the participants. The results also indicated that only a young participants were more positive towards the adoption of m-health technologies. Therefore, we recommend the young group to be co-developer for m-health technologies in Kuwait. This study also recommends that top-managements of private healthcare institutions and the government need to inspire the value-added creation for healthcare services through the development of m-health apps.

This study suggested that m-health app users in Kuwait are ready to adopt m-heath apps because they are already using myriad of various types of apps from other field inclusive of food, fashion, and travel. The application of m-health seems to be next logical step to be taken in Kuwait. This study also recommended that the m-health technology providers who would introduce this app to Kuwait is to focus on the utilization of the market planning model. However, one of the obstacles that given by participants for not using m-health apps because the nature of healthcare industry is highly regulated and complicated environment.

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