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Research paper

Technology acceptance of mobile health applications in GCC countries: case of Kuwait

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Abstract

Information technologies solutions have proven to bring many opportunities. For instance, the information technologies have proven to improve the efficiency and effectiveness of healthcare in the developed countries. However, the drivers and barriers to accept mobile applications and information technologies adoption within healthcare are little researched for the GCC countries where the information technologies adoption is relatively new. The current research is a pilot study that investigate unbiased evaluation of different end-users' views on information technologies solutions in Kuwait. To catch up with the growth, the GCC countries have attempted to revolutionize the healthcare systems throughout the applications of information technologies solutions including mobile computing solutions and educate users with better methods to receive customized health services. The present paper examined the issues by using the framework of Technology Acceptance Model (TAM) and Q methodology to grasp insights and reflections of different viewpoints of end-user's adoption factors. One of the findings indicated that the perceived security risk was the least an obstacle factor for mobile applications adoptions and acceptance. Another chief factor for such adoption is the perceived usefulness and perceived ease of use domains which present significant elements for the escalating embracing of mobile health application among end-users in Kuwait. Accordingly, the data analytics indicated two factors labeled as "technology readiness" competent end-users and "risk insensitive" end-users.

Keywords: *Information Technology; Kuwait; Q Method; Technology Acceptance Mode (TAM); Mobile Health applications.*

1. Introduction

Information technologies solutions have proven to bring many opportunities despite the efforts to mitigate the augmented challenges inclusive of medical errors, legal accountability and expenditures. Therefore, the information technologies solutions have been utilized to reach the efficiency levels and effectiveness of healthcare service and quality in the developed countries [5] [20] [13] [14]. On the other hand, the healthcare sector in Gulf Countries Council (GCC) countries- the politically and economically tied-allied inclusive of Saudi Arabia, United Arab Emirates, Oman, Qatar, Bahrain and Kuwait is critical. In Kuwait, the government has been facing numerous challenges such as upraising healthcare expenditures, amplified medical errors and low productivity and low efficiency. This has exerted greater pressure on IT professionals and expertise to find the most effective blend of new information technology for the healthcare solutions to mend healthcare services and educate users.

It is critical to note that this is one of most complex sectors which requires loads of information and knowledge. Following the footsteps of developed countries, the only single promising solution seems to overcome the incurred challenges is to utilizing information technologies to its fullest inclusive of mobile health applications which seems an optimal approach to re-engineering the healthcare sector [7] [20] [28]. This promising solution is identified as the application of mobile health computing (known as m-health apps) technologies to solve the escalating challenges in healthcare sector.

Totally, the GCC governments' expenditures on healthcare domain are expected to reach seventy-one billion dollars by the year 2020 whereas Kuwait makes up around 11 percent of the total project monetary values spent within the GCC countries. Another driver behind the motivation to emphasis on healthcare sector particularly in Kuwait is constant low-priced oil (hint reduced oil revenues) milieu might chiefly influence the financial planning amongst GCC governments and, hence, rocket healthcare expenditure. Furthermore, a growing population composition, aging demographics measures, lifestyle, chronic and acute illness, and medical domain have led government initiatives to emphasis on restricted budget to provide quality of healthcare services to fuel the growth in the healthcare sector. Due to scarcity of research on information technologies applications solutions in the Middle East region, particularly, Kuwait, this paper sought to explore attitudes and perceptions to m-health applications and domains [1] [15] [27] [10] The existing study recognizes that the exact nature of the effect of information technologies infrastructure and its solutions on healthcare sector could be substantial reform and/or even revolutionary. It also recognizes the variety of end-users such as medical practitioners, informal and formal healthcare providers, healthcare staff, students, patients and interested members of society in Kuwait. Additionally, there may be numerous needs sprouting around information technologies and mobile health applications. For this reason, it is critical to understand the issue from different breadth and depth of information required by different groups of end-users 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 end-users of information

technologies 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 information technologies 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].

2. Literature review

This study explores the trend of mobile health applications acceptance and adoption by the framework of Technology Acceptance Model (TAM), the original and extended TAM models, and Q method. In the literature, the chief theoretical model that explains the acceptance of users and their adoption to a new technology is TAM model. The TAM model integrates the diffusion innovation theory to better explain the new needs of end-users of new technology tools or other channel of communication and the factors that might influence the end-users' decisions [12] [25] [18]. Ultimately, the success of information communication interventions and innovations of electronic channels is reliant on the utilization of information technology by the target end-users. It is known that original TAM model explains the adoption and acceptance of end-user of any new nascent technology by several domains: perceived usefulness, perceived ease of use, and behavioural intention to use as depicted in fig.1. The abbreviations are used to refer to these domains throughout the paper. The end-users' 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 end-users intend to use the new information technologies to enhance the performance of their job (or goal) and flourish the health outcome goals [12]. The PEU domain might give reasons and incentives for end-users as it is the easiest way of communication channel in healthcare setting. Furthermore, the validity and reliability were established by including six items to measure each PU and PEU respectively. Alternatively, another adjusted TAM model is also like the original model as it added one more domain: Subjective Norm (SN) or social influence (peer pressure from colleagues, bosses and significant others) to define the opinions of different end-users of information technology tools. Therefore, the intention to use any types of information technology is triggered by social pressure considered as perceived social pressure. This research relies on TAM model and its domains. This research aims to better capture the subjective views of information technology, an innovative research method is used here known as a Q method.

Numerous constituents of studies applied TAM's models to investigate the acceptance and adoption of technologies and its embedded information in diverse workplaces regarding the new technology. Alternatively, healthcare pipeline was added recently in the literature to include perception of health information technologies used by diverse end-users such as physicians, nurses, and clinicians [16]

[31] [24] [26]. Another earlier thread include research on electronic health records (EHR) and Health Information Technology (HIT) which was added to literature [6]. Moreover, most previous studies are related on the research conducted to evaluate the applications of HIT including personal digital assistants, radiological image archiving and communication systems and telemedicine technology.

A related strand of literature focused on health end-users' behaviours 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]. Correspondingly, TAM model has been commonly used as effective method to measure end-user's approval of technologies in any economic sectors inclusive of m-health, information technologies and telemedicine research [23]. Another recent study applies TAM in a more stakeholder's health informatics setting [17].

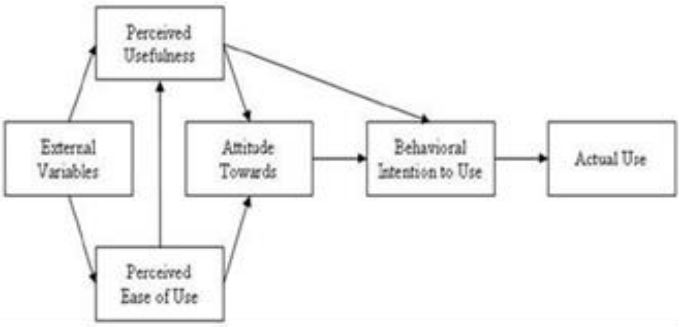

Fig. 1: The Original Tam [12].

Perceived behavioural control (PBC) was derived from the theory of reasoned action and theory of planned behaviour that connect between three domains: behaviour, beliefs and attitudes. Altogether this domain shapes an individual's behavioural intentions and behaviours [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 by taking into the consideration perceived security measure. How secure the m-health information technologies?

Generally, the literature shed lights on the major factors associated with behavioural intention to exploit any type of technology could be grouped into four perspectives: individual perspective, system perspective, social perspective, and organizational perspective. While social perspective means social influence on personal acceptance of information technology, organizational perspective 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 perspective variables. They reported that the organizational perspective 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 literature, factors related to adoption and acceptance of information technologies have four contexts: Individual, System, Social Pressure, and Organizational. Moreover, one may explore an individual attitude towards information technology by examining two focal constructs: one cognitive construct and the other is behavioural construct. For this significant drive, this study smears TAM method to measure cognitive construct by using PU, PEU and PBC domains as explained earlier, whereas SN domain is used to measure subjective intention by taking into account individual differences (i.e. gender, age, educational levels, marital status and employment status) to use health information technologies as depicted in Fig. 2.

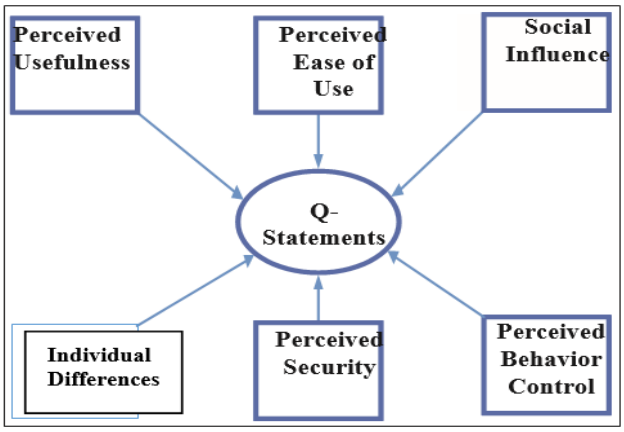

Fig. 2: Constructs of TAM and Q Methodology.

3. Research design

3.1. Q Method

The purpose of this research is to smudge the six constructs from the TAM model and further apply Q method to better explain end users' attitudes towards the nascent information technology acceptance and its adoption. Q method is a commonly applied mixed method approach known in the literature [2] [3] [4] [22]. It is developed primarily to examine end-users' perceptions and attitudes [29]. In general, the topic under investigation is presented to end-users as statements (known as a Q-set) from which the participants rank them according to their preferences to reveal their perceptions and perspectives [8]. Then, factor analysis is conducted as data analytics process. In this way, it is possible to identify significant clusters of correlations that can be described as common perception known as factors [9]. Figure 3 outlines the Q methodology process to show the various steps to the generation of a pool of relevant statements related to the perspective of study.

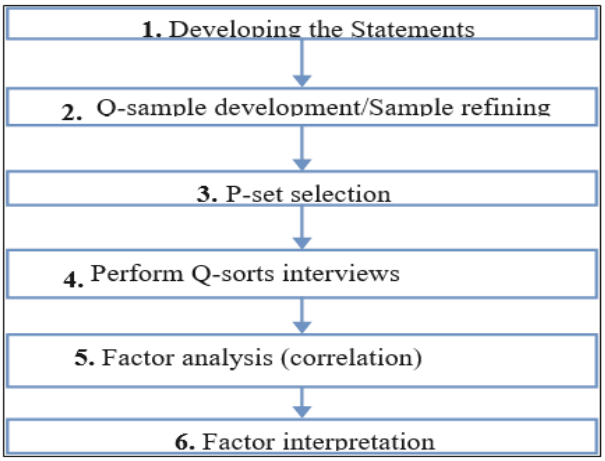

Fig. 3: Q Process.

3.2. Concourse stage

In the present study, the end-users' opinions of health information applications as an example of information technologies extracted from diverse users in Kuwait inclusive of medical practitioners, medical students at University of Kuwait. In the first stage, a concourse as shown in Fig. 4 [29] is conducted where a representative group of end-users were encouraged to produce as many statements as they could to represent their diverse point views on m-health applications based on their experience and knowledge (known as brain storm sessions). A concourse is conducted to collect the entire the views and opinions (not facts) on the subject at hand, provides the raw material for setting up a Q study [22]. Once the entire statements are collected, reviewed and refined to remove any duplicates. It is worth noting that statements not only collected during the concourse stage and obtained by the researchers from secondary sources in the literature. In total, fifty (50) items made up the final set of statements, which is known as the Q-sample.

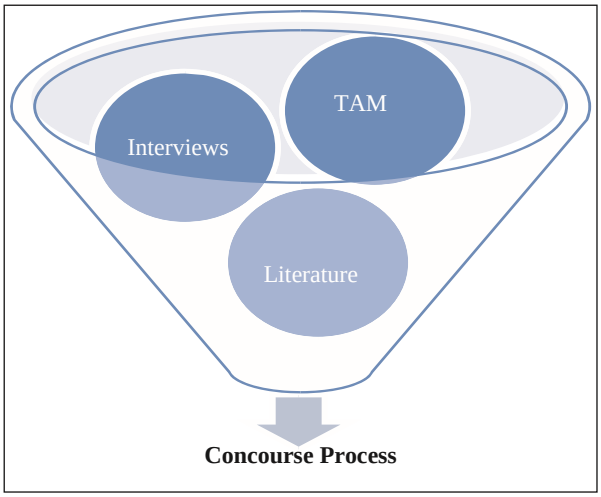

Fig. 4: Concourse Stage of Q Methodology.

3.3. Sorting stage

In the second stage of a Q method, end-users 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 end-users 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.

3.4. P-Set selection

The end-users are instructed by the researchers to read and inspect carefully the Q-sort and reflect thoroughly on ranges of opinions on a health information technologies issue. At the same time, the end-users are instructed 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 m-health information applications source. The next step in sorting was to ask end-users to focus on the first sets of statements then they reread thoroughly through that pile, then carefully select the ones they considered most important (positive), and places its corresponding number under the +5 column on the Q sort scale as in the figure 5 below. Then the end-users continue repeating the same step for remaining columns (neutral and negative) until entire Q-sort is accomplished and have been placed on the data sheet (Q-grid) [16].

In the present study, there were thirty (30) end-users who successfully sorted the 50 refined statements that covered elements they would want on a health mobile application as an example of information technology. This stage was completed it on average one hour and involved with diverse users such as nurses, general practitioners, medical students in Kuwait, taking time away from their duties to do so. Most end-users were male (nearly 60 % males). Their ages ranged from 21 to 50 years. There were 40% female end-users 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).

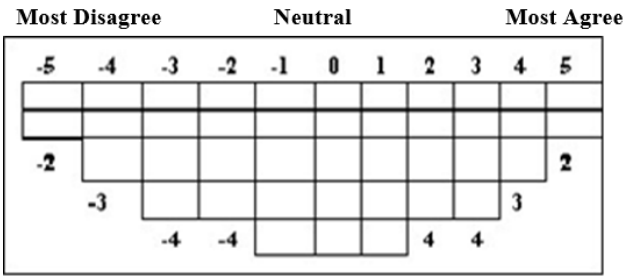

Fig. 5: Q-Sort Scale (Q-Grid).

4. Discussion of results

In this study, a two-factor solution was selected for the interpretation of the data. This is mainly because 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 end-users (73%), whereas eight end-users 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 1. The 2 Factors are now labelled as "technology readiness" competent and "risk insensitive" end-users.

Table 1: Socio-Demographics of P-Sample

Demographic	P Sample	N (%)
Age, years		
18-24	10	33.33%
25-30	15	50.00%
Greater 30	5	16.67%
Level of education		
Undergraduate	5	16.67%
Master degree	10	33.33%
PhD	15	50.00%
Others	0	0.00%
Employment Status		
Student	5	16.67%
Unemployed	5	16.67%
Employed	20	66.67%
Marital Status		
Single	12	40.00%
Married	18	60.00%
Total	30	100.00%

Fifteen end-users loaded significantly onto Factor-1. Table 2a and Table 2b 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 information technologies and m-health applications may bring to all end-users 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 behavioural control. This implies that this factor is technology confident and competent. Therefore, this factor is labelled as "technology readiness" to adopt innovations in e- health.

Table 2: A) 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 support 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 2b expand this view further by listing the main statements with which the end-users 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 end-users 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 2: B) 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	End-users 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 end-users. Table 3a and Table 3b contain the significant statements loaded into Factor 2. The strongly agreed statements in Table 5a imply that the end-users 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 labelled as "risk insensitive" group. On the other hand, from the strongly disagreed statement in Table 3b, this group in Factor 2 does not have concerns around privacy issues as reflected in statement 49. The end-users 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 2: A) 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 3: B) Factor -2 'Strongly Disagree' 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	End-users 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

5. Conclusions & recommendations

In the recent paper, TAM model has proven to assist researchers with constructs and method. In addition to TAM model, Q method played a significant role to provide future potential capability addressing several perceptions of end-users towards information technologies solutions in perspective of m-health applications in Kuwait. The present paper emphasized on factors perceived to impinge on effective use of m-health applications as information technologies solutions in Kuwait. The present study provides a systematic review of subjective attitudes which has demonstrated that information technologies solutions offer a modern measure to meet both current and future challenges of healthcare domains.

Generally, the findings indicated that there is a strong evidence to support the m-health applications as an example of information technologies in domains of its usefulness and ease of use. Meantime, there was an apparent weak evidence of social support for its implementations and acceptance of m-health applications. This 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 concern among diverse groups, end-users appreciate the optimal benefits of technical innovations. This suggests that the various end-users regardless of individual differences 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 infancy stage of adoption and acceptance. This can be solved by encouraging government in Kuwait to plan of healthcare strategies and implementation of health promotion-related information technologies tools. The pressure would highly be likely to push the progress in the future of healthcare that requires intensified co-operation and networking of end-users which is still in its early 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 using artificial intelligence system.

In this paper, the results indicated that there were not any significant trends on the levels of education and professions of the participants. The results also indicated that only 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 Sector is highly regulated and complicated environment.

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