Critical Success Factors Affecting Information System Satisfaction in Public Sector Organizations: A Perspective on the Mediating Role of Information Quality

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ABSTRACT

Many studies have investigated technology adoption in western countries and ignored the Arab region. The available Arab studies focused on the technology adoption model (TAM) and its subsequent variations while leaving important factors such as information quality, user involvement, availability of training and top management support on the success of information systems (IS). Despite that these factors were studied scantily in some past studies, this research attempts to fill this gap and develop a more integrative model of IS success. Results indicated the existence of four critical success factors, three organizational factors (management support, training, user involvement), and an information system factor (information quality), that affect IS success (use and satisfaction). Results found that information quality for the first time mediates the effect of the three organizational factors on IS success, while TAM components (perceived usefulness and perceived ease of use) have no effect.

KEYWORDS

Empirical Study, Information Quality, System Usage, TAM, Top Management Support, User Involvement, User Training, User's Satisfaction

INTRODUCTION

The role of information systems (IS) in gaining competitive advantage in business has received extensive coverage and debate in the literature (Carr, 2003). IS research in developing countries emerged to grasp the benefits of using IS technologies to improve business processes and enhance productivity. However, it has been argued that it is not the IS solution itself but its utilization in business what provides competitive advantage (Al-Qirim, 2007a). Insights from practice has shown

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that a significant percentage of IS failure can be attributed to low level of end-user acceptance and use particularly in developing countries (Heeks 2002; Amid et al., 2012). This triggers the importance of having continuous research about critical success factors (CSF) that affect IS success. In this study, we refer to IS success as factors that affect current use and IS satisfaction which are commonly accepted and used (DeLone and McLean, 1992; Rouibah et al., 2009; Gorla et al., 2010; Rouibah et al., 2015). Over the last three decades numerous CSF were considered either in IS success model or in the technology acceptance models. Among the studied CSF the following: information quality (Wixom and Watson 2001; DeLone and McLean, 1992; DeLone and McLean, 2003; Almutairi and Subramanian 2005; Gorla et al., 2010; Rouibah, et al., 2015; Ou et al., 2016), system quality (Wixom and Watson 2001; DeLone and McLean, 1992; DeLone and McLean, 2003; Almutairi and Subramanian 2005; Gorla et al., 2010; Rouibah, et al., 2015; Ou et al., 2016), service quality (DeLone and McLean, 2003; Gorla et al., 2010; Rouibah et al., 2015; Ou et al., 2016), perceived usefulness (PU) and perceived ease of use (PEOU) (Davis 1989; Igarria et al., 1995, 1996, 1997; Rouibah et al., 2009), the availability of training (Igarria et al., 1995, 1997; Rouibah, et al., 2009), top management support (Igarria et al., 1995, 1996, 1997 ; Wixom and Watson 2001; Anandarajan et al., 2002; Al-Gahtani 2004 ; Rouibah, et al., 2009; Bano et al., 2016; Al-Qirim, 2007a,b), end-user involvement (Frantz and Robey 1986; Kujala 2003; Santosa et al., 2005; Rouibah, et al., 2009; Bano et al., 2016), intrinsic and situational motivation (Santosa et al., 2005), social influences (Karahanna et al., 1999; Al-Gahtani et al., 2007; Rouibah, 2008), and facilitating conditions (Al-Gahtani et al., 2007).

The implications arising from the popularity of IS success research is fourfold. First, while we observed that most studies focused on identifying CSF in developed countries, fewer studies have focused in top IS journals on developing countries in general (Anandarajan et al., 2002; Al-Gahtani et al., 2007; Rouibah et al., 2009) and on the Arab world more specifically (i.e., see published papers in leading MIS journals between 1991 and 2017: Legris et al., 2003; Schepers and Wetzels 2007; Turner et al., 2010; Shaikh¹ and Karjaluo 2015; Abed et al., 2015). Second, there is a shortage of research on IS success in public organizations in the Arab world. The available research points to the high failure rates of IS implementation in such organizations (Goldfinch 2007). The majority of IS studies have either focused on consumer adoption of individual technologies (e.g. e-commerce, e-government, e-payment) outside the workplace (Rouibah 2008; Rouibah et al., 2015; Rouibah et al., 2016), while fewer studies have focused on employees in private organizations (Al-Gahtani 2004, Al-Gahtani et al., 2007; Rouibah et al., 2009; Abed et al., 2015). For example, public institutions in developing countries in the Gulf region are mostly not driven by profit, highly centralized, have more resources and their employees have less demand for performance as compared to private organizations. In addition, public institutions own the largest segment of the IT market (70% to 90%). Accordingly, it is expected that some CSF that affect IS success in private organizations may have no impact on such public organizations. Third, Delone and McLean model (1992 and 2003) is one important model in IS field. Several organizational factors (economic, political, cultural, technical, and behavioral) that influence IS success were added to this model (Rouibah et al., 2009). However, while previous studies (Rouibah et al., 2009) have studied the effect of the three factors on IS success through the mediation of TAM beliefs in private organizations, more research is needed to consider quality attributes as well. In fact, these modifications lack consistency with the marketing studies on customer behavior and TAM research (Davis 1989) when they are included in DeLone and McLean (2003) model. The marketing literature suggests linking quality attributes to perceived-value-to-satisfaction that influence end-users adoption and success while TAM model suggests linking beliefs to attitude-and-behavior (Davis, 1989). Thus, more studies are needed to organize the link between these constructs when they are integrated together. Fourth, while IS quality attributes received extensive focus through replications and modifications of DeLone and McLean IS success model, what is surprising is that no research examined antecedents of information quality aspects more specifically and focused on its dimensions only. For example, Wixom and Watson (2001) studied factors affecting data warehouse success and pointed to the need to conduct more studies on factors that affect information quality.

In addition to TAM model, other studies found that information quality affects IS success in term of use and satisfaction (McLean and Delone 2003; Khalil and ElKordy 2005) and is the most important factor explaining frequency-of-use (Dwivedi et al., 2013; Ou et al., 2016) as well as the degree of end-user satisfaction (McGill et al., 2003; Floropoulos et al., 2010).

Understanding the factors that possibly influence IS success is crucial, however, most previous research focused on IS quality attributes, benefits, and impact of IS use (e.g. Delone and McLean 2003; McGill et al., 2003; Dwivedi et al., 2013; Rouibah et al., 2015; Ou et al., 2016). Others focused on organizational factors such as top management support, availability of training and end-user involvement (Igbaria et al., 1995; 1997; Al-Gahtani 2004; Anandarajan et al., 2002; Rouibah et al., 2009). Studies attempting to integrate both streams are rather missing. In addition, the literature on information quality is mostly prescriptive in nature and empirical evidence that links antecedents of information quality to IS success is also limited. In addition, IS systems adoption models (e.g. TAM, TRA, TPB, etc.) produced useful insights to individual's behavioral reactions to IS and the factors that may influence such reactions. But, despite the empirical evidence of the relationship between user perceptions and IS use, little is known about how information quality and its antecedents may impact IS success.

Thus, this study focuses on combining part of the DeLone and McLean (2003) with the marketing literature and TAM. It aims to link three external organizational factors with TAM through the effect of information quality on IS success. Accordingly, the research question that we aim to answer is: Does information quality mediate the effect of the three external factors (directly or indirectly) on IS use and end-user's satisfaction or no?

This research provides three main contributions. First, it is the first study that tries to reconcile DeLone and McLean (2003) with TAM through the addition of three external factors. This model links three external factors (end-user involvement, top management support and availability of training) to information quality to beliefs of TAM (PU and PEOU) to IS success constructs to show the role played by information quality in IS success. Second, this study validates the proposed research model in an Arab country using a random sample involving 526 employees in different public institutions in Kuwait and is analyzed using LISREL SEM tool. Third, the findings of this study could provide unique insights for both researchers and professionals to better understand the role played by antecedents to IS success and to suggest ways to increase IS success in public institutions.

RELATED WORKS AND CONCEPTUAL RESEARCH MODEL

The Technology Acceptance Model (TAM) and Its Modifications

TAM is derived from the theory of reasoned action. It is assumed that the decision to use a particular IS is based on a cognitive process (PU and PEOU) toward using the system, which in turn results in an affective response (attitude) towards that IS. The affective response drives the intention and use of the system. Other studies extended TAM with many several factors (Legris et al., 2003) such as system quality, user training and top management support (Igbaria et al., 1995), complexity, skills, organizational support and organizational usage (Igbaria et al., 1997), top management support and training (Igbaria et al., 1997, Anandarajan et al., 2002; Al-Gahtani, 2004; Rouibah, et al., 2009). However, there is a lack of studies that focus on adding mutually external organizational factors (see Hong et al. 2014), quality attributes (McLean and Delone 2003) and beliefs constructs of TAM (PU and PEOU) to IS success.

IS Success in the Arab World and Information Quality

DeLone and McLean (1992) introduced their comprehensive IS success model, noted here as D&M, that includes six major dimensions. Information quality and system quality both mutually affect IS use and satisfaction. The level of use and end-user satisfaction may affect each other positively

or negatively. And IS use and end-user satisfaction affect the net benefits which in turn affect the organizational impact. This model was later modified and increased with quality components (DeLone and McLean 2003). Information quality, system quality and service quality all affect IS use and satisfaction. In turn, IS use and satisfaction both affecting net benefits.

Delone and McLean models (1992 and 2003) have received extensive validation on different technologies, i.e., Web portal success (Al-Debei et al., 2013), general information systems success (Almutairi and Subramanian 2005; Gorla et al., 2010), data warehouse success (Nelson et al., 2005), B2C success (Rouibah et al., 2015), online social networking success (Ou et al., 2016), RFID success (Dwivedi et al., 2013), and e-government success (Floropoulos et al., 2010).

Concerning the IS success model of DeLone and McLean (2003), we can raise the following observations about our research focus. First, the net benefits measure is not well defined and there is a need to specify how to measure it, and who are the beneficiaries. Second, DeLone and McLean (2003) did not try to unify and align in their model the net benefit with usefulness of TAM that gives the model parsimonious and richness. Third, DeLone and McLean (2003) model lacks consistency with the marketing and customer behavior literature that proposed a chain of quality, value, satisfaction that influences end-users. In this study we consider PU, use and user satisfaction, as all forms of net benefits measures.

The literature review done by Rouibah et al., (2009) has revealed that very few studies have investigated the critical success factor of IS success in the Arab world in top IS journals. Khalil and Elkordy (1999) explored the relationship between system usage and end-user satisfaction in Egypt, while excluding external factors. Al-Gahtani (2004) studied the effect of organizational and technological factors in Saudi Arabia. They included management support and training, however he omitted user involvement which is as an important factor in IS success (Frantz and Robey 1986; Kujala 2003) and he did not follow logical flow of paths between constructs as suggested by D&M, marketing studies and TAM. Other studies replicated the IS model in the Arab context. Almutairi and Subramanian (2005) validated the McLean and Delone (1992) in private organizations in Kuwait while Al-Debei et al. (2013) replicated Delone and McLean (2003) for web portal success. Rouibah et al. (2015) is the only study that improves D&M model in e-commerce context. Khalil and Elkordy (2005) examined antecedents and consequence of information quality. They included PEOU, user involvement, IS maturity and IS sophistication (like system quality) as antecedents of information quality, while they limit the consequences to only IS use. Rouibah et al., (2009) developed a model that go beyond quality attributes and links three organizational factors to IS success through the mediation of PU and PEOU, which will be explained next. Although these were useful in clarifying factors affecting on IS use in the Arab world, joint effect of the different paths among organizational factors with the inclusion of information quality and their effect on IS success was not a concern.

Rouibah et al., (2009) Model: The Foundation of Our Study

By further combining literature from the IS and marketing fields, our research model builds on the model proposed by Rouibah et al, (2009). This model is based on TAM and links three exogenous variables (availability of training, top management support, and end-user involvement) to IS success through the mediation of TAM beliefs. They validated their model with a sample of Kuwaitis in the private sector. They found that the three external factors influence both PU and PEOU. PU affects actual use and end-user satisfaction, while PEOU has only an effect on end-user satisfaction. Authors called for more studies that integrate TAM and D&M by integrating quality attributes of D&M in this model.

Improvement of Rouibah et al., (2009) by Information Quality

Quality is defined in organization in term of quality as value, quality as conformity/compliance to requirements/specifications, and quality as exceeding end-users' expectations (Reeves and Bednar 1994). IS quality according to Gorla et al. (2010) could be achieved through objectives. Distinctions

in IS quality includes using the latest and innovative technologies and delivering performance without errors. The benefits of IS may be achieved by providing useful and not complex system applications. IS quality as conformance/compliance refers to the design of ISs that satisfy end-users' requirements. Exceeding end-user's expectations of IS quality is achieved by delivering user-friendly IS interfaces and meet their needs. Accordingly, IS quality plays an important role in the success of IS function, and an important factor in IS success models. Besides information quality system quality and service quality received extensive focus on IS studies and DeLone and McLean (1992, p. 88) called for further improvement of and validation of the IS success model "much work is still needed, particularly in assessing the impact of information systems on organizational performance" in other settings and cultures.

Many studies replicated D&M model (Almutairi and Subramanian 2005; Al-Debei et al., 2013), while other included modifications and adjustments (Nelson et al., 2005; Gorla et al., 2010; Rouibah et al., 2015). Among the carried modifications, Nelson et al., (2005) added three sub factors on quality attributes (completeness, accuracy, format and currency), while Gorla et al., (2010) posit system quality as antecedent of information quality. However, organizational factors that may affect system quality were not studied.

Among the three quality attributes of D&M (2003), our study focuses solely on the information quality attribute since the focus is on the use of IS by employees in public institutions. This is due to the increased dependence of public organizations on IS and their failure because of poor information quality (Ravichandran and Rai 2000). This is what led Gorla et al, (2010) to note that despite the increase in IS importance, IS quality issues did not receive enough attention by the IS research community. We concur here that this issue has received little attention in developing and Arab countries as well. To further emphasis the importance of this issue we use the arguments of Ackoff (1967) related to the misunderstandings related to IS design by stating, "The most important informational deficiency the managers suffer from is abundance of irrelevant information." Problems related to information quality (data entree errors, incorrect output information, due to wrong end-user requirements) still exist today (Gorla et al., 2010). Information quality refers to the desirable characteristics of the system output (referring to IS quality as value) as well as report outputs that meet end-users' requirements (representing IS quality as compliance and conformance to IS specification) (Gorla et al., 2010).

Several dimensions of information quality were proposed. The most well-known is the instrument of Doll and Torkzadeh (1988) that includes several dimensions (accuracy, timeliness, up-to-date/currency sufficiency, content, precision, clarity, format, and ease of use). Delone and Mclean (1992) suggested five other measures (accuracy, timeliness, currency, completeness, and relevancy), which were used in our research model, and like previous studies (Nelson et al., 2005; DeLone and McLean, 2003; Gorla et al., 2010). We excluded others (format and ease of use) of Doll and Torkzadeh (1988) since they are system quality functions influenced by the hardware/software system itself while other (content, precision and clarity) were not accepted during the test phase. Accuracy or content refers to the level of correctness and reliability of information (Wang and Strong, 1996). Timeliness refers to the availability of output information at the needed time (Bailey and Pearson, 1983). Completeness is the level at which information includes all the essential elements to complete tasks (Bailey and Pearson, 1983). Relevancy refers to the level at which information can be applied and be helpful to complete tasks at hand (Bailey and Pearson, 1983). Currency refers to the degree to which information is up-to-date during decision making (Wang and Strong, 1996).

In the following section, three independent variables will be added as antecedent of information quality: availability of training to represent institutional practices of quality management, top management support to represent senior management leadership role, and end-user involvement in system development and software purchase representing management leadership and establishment. These three factors are rooted in the resource-based theory (Conner, 1991). This theory explicitly recognizes the importance of intangible resources to achieve competitive advantages. And the

resources needed to implement strategies are available and distributed across different organizational businesses units (Barney, 1991).

RESEARCH MODEL AND HYPOTHESES DEVELOPMENT

The research model is shown in Figure 1. It is built upon previous model of Rouibah et al. (2009) and previous efforts (Igbaria et al., 1995, 1996, 1997; Anandarajan et al., 2002), with the inclusion of information quality. In this study we limit our determinants of information quality to resources

Figure 1. Research model

controlled by organizations as suggested by the resource-based theory of the firm; we excluded system quality and service quality from our model.

This model links three exogenous variables (top management support, availability of training, and end-user involvement) to an endogenous variable (end-user satisfaction) through the mediation of four variables (information quality, PU, PEOU, and actual use). Since this model represents an extension to our previous research model (Rouibah et al., 2009) we will only explain the new hypotheses while listing existing and validated hypotheses that were set forth according to previously validated studies:

H1b: Top management support will have a positive direct impact on PU (Igbaria et al., 1995, 1996, 1997; Rouibah et al., 2009).

H1c: Top management support will have a positive direct impact on PEOU (Igbaria et al., 1995, 1996, 1997; Anandarajan et al., 2002; Rouibah et al., 2009).

H1d: Top management support will have a positive direct and indirect impact on IS usage (Igbaria et al., 1995, 1996, 1997 [only indirect effect]; Anandarajan et al., 2002; Al-Gahtani, 2004; Rouibah et al., 2009).

H1e: Top management support will have a direct and indirect impact on end-user's satisfaction (Anandarajan et al., 2002; Al-Gahtani 2004 [direct effect]; Rouibah et al., 2009).

H2b: Availability of training will have a direct impact on PU (Igbaria et al., 1995, 1997; Rouibah 2009).

- H2c:** Availability of training will have a direct impact on PEOU (Igbaria et al., 1995, Rouibah et al., 2009).
- H2d:** Availability of training will have a direct and indirect impact on IS usage (Igbaria et al., 1995, 1997; Al-Gahtani 2004 [only direct effect]; Rouibah et al., 2009).
- H2e:** Availability of training will have a direct and indirect impact on end-user's satisfaction (Al-Gahtani 2004; Rouibah et al., 2009).
- H3b:** User involvement will have direct and indirect impact on PU (Frantz and Robey 1986; Kujala 2003; Rouibah et al., 2009).
- H3c:** User involvement will have direct impact on PEOU (Rouibah et al, 2009).
- H3d:** User involvement will have direct and indirect impact on IS usage (Igbaria et al., 1997; Rouibah et al., 2009).
- H3e:** User involvement will have direct and indirect impact on end-user's satisfaction (Kujala 2003; Santosa et al., 2005; Rouibah et al., 2009).
- H5a:** PEOU will have direct impact on PU (Davis 1989; Igbaria et al., 1995, 1996, 1997; Rouibah 2008; Al-Gahtani et al., 2007; Rouibah et al., 2009).
- H5b:** PEOU will have direct and indirect impact IS usage (Igbaria et al., 1995, 1996, 1997; Anandarajan et al. 2002 [direct effect], Rouibah et al., 2009).
- H5c:** PEOU will have direct and indirectly impact on end-user's satisfaction (Al-Gahtani 2004; Rouibah et al., 2009).
- H5d:** PU will have direct impact on IS usage (Igbaria et al., 1995, 1997, 1997; Al-Gahtani 2004; Rouibah et al., 2009).
- H5e:** PU will have direct and indirect impact on end-user's satisfaction (Anandarajan et al. 2002; Rouibah et al., 2009; Rouibah et al., 2015).

Antecedents of Information Quality

Information output that will not fulfill end-users' requirements will result either in maintenance costs, disruption of processes or simply in IS failure in the organizations (Swanson, 1997). Accordingly, involvement of top-management-support (TMS) to guarantee the quality of information output is a prerequisite to reduce such maintenance cost. Here we define TMS as the support provided by top management to end-users such as providing: system development assistance and persons to solve problems guidance and encouragement in using IS, and procedures to apply total quality management principles. In addition, TMS will also ensure that an IS project will receive sufficient funds and resources to be successful in term of the quality of the delivered output. For the first time, we posit that the more top management provides support for IS, the higher information quality will be, measured in term of the five attributes (accuracy, timeliness, completeness, relevancy, and currency) used in this research and adapted from previous data quality instruments (DeLone and McLean 2003; Gorla et al., 2010; Rouibah et al, 2015). Thus, the following hypothesis is inferred:

- H1a:** TMS will have a direct impact on information quality.

The availability of training programs for end-users within organizations is of crucial importance to IS implementation success. These programs help solve ambiguities surrounding IS and increase skills of users as well as their familiarity and contribute to lessen their resistance to newly introduced ISs. The more end-users are exposed to training the more likely they would be positively influenced to use the system (Igbaria et al., 1995; Igbaria et al., 1997). End-users will not perceive the value of a system and continue to use it unless it delivers high quality output. The more end-users receive adequate trainings the more they likely to express their requirements in terms of information quality (accuracy, timeliness, completeness, relevancy, and currency). Thus, for the first time we infer:

H2a: Availability of training will have a direct impact on information quality.

End-user involvement in IS design or requirement collection is the third antecedent of information quality in the research model. It is a viable strategy to ensuring successful IS implementation (Baroudi et al., 1986; Santosa et al., 2005; Rouibah et al., 2009). User involvement in systems-building process increases the chances of IS success and usage because end-users have more chances to shape the IS to meet their requirements. If end-users are not involved IS may be designed with a poor user interface to return the information in the required quality attributes. An IS project will be judged as a failure if it does not return the necessary quality output. End-users involvement in the IS acquisition has two expected outcomes. First, if end-users are involved in IS acquisition, they have more chances the system fit their requirements, control the quality the information processing, and thus have more chance to view outcome with the information quality attributes they have defined. Second, linked to the previous point, end-users will likely react positively to a completed system. Khalil and Elkordy (2005) indicated that end-user involvement in system acquisition results in a higher user perception of the system's information quality attributes and more usable system. Thus, for the first time we posit the following hypothesis:

H3a: User involvement will have a direct impact on information quality.

CONSEQUENCES OF INFORMATION QUALITY

Empirical studies that have tested the original Delone and McLean (1992) model (e.g. Almutairi and Subramanian 2005; McGill et al., 2003; Floropoulos et al., 2010; Dwivedi et al, 2013; Ou et al., 2016) or the modified Delone and McLean (2003) (e.g. Rouibah et al., 2015) found that the more end-users observe the information quality attributes as important the more likely they will perceive its usefulness (Wixom and Watson 2001; McGill et al., 2003; Floropoulos et al., 2010; Rouibah et al., 2015), the more they use the system (Almutairi and Subramanian 2005; Nelson et al., 2005; Dwivedi et al., 2013; Rouibah et al., 2015), and the higher their satisfaction will be when they use it (McGill et al., 2003; Almutairi and Subramanian 2005; Nelson et al., 2005; Floropoulos et al., 2010; Dwivedi et al., 2013; Rouibah et al., 2015). Thus, we infer the following hypotheses:

H4a: Information quality will have a direct impact on PU.

H4b: Information quality will have a direct impact on actual use.

H4c: Information quality will have a direct and indirect impact on user's satisfaction.

System Usage and End-User Satisfaction

Use and end-user's satisfactions have been proposed as two dimensions of IS success and are central taxonomies of success (DeLone and McLean 1992; 2003; Doll and Torkzadeh 1991; Doll and Torkzadeh 1998). End-user satisfaction refers to the degree to which the end user is satisfied with the available system. IS use was operationalized in different ways (Doll and Torkzadeh 1998). In this study, we operationalized use and end-user satisfaction through the self-report coverage by subjects.

The link between usage and end-user's satisfaction has been studied by several past studies (Doll and Torkzadeh 1991, DeLone and McLean 1992, McGill et al., 2003; Delone and McLean 2003; Rouibah et al., 2009). The majority found use has direct impact on satisfaction (Baroudi et al., 1986; Anandarajan et al., 2002; Dwivedi et al., 2013). In addition, Arab empirical studies (Khalil and Elkordy 1999; Al-Gahtani 2004; Rouibah et al., 2009; Al-Debei et al. 2013) found that IS usage affects end-user's satisfaction. Thus, our study tests the last stream and infer the following:

H6: IS usage will have a direct impact on user's satisfaction.

RESEARCH METHOD AND DATA COLLECTION

Authors used the survey instrument to measure individuals' perceptions related to factors of the proposed research model.

Survey Procedure and Data Collection

This study targets end-users in all public-sector organizations in Kuwait (n=53). The total sample size was randomly selected from different public-sector organizations. Participation was voluntary, and since the postal system is not reliable, and to increase the reliability of data collection, one of the authors visited these organizations, and after obtaining the necessary approvals to conduct the study he visited the different public departments and got a list of employees and departments' managers who use IS. Two criteria were used to guarantee the reliability of the instrument (Almutairi and Subramanian 2005): The employees should directly use IS applications in his/her work and the manager should either directly or indirectly reading IS output and use the IS. He then distributed the questionnaires in a paper format and explained to respondents the purpose of the study and the anonymity of his/her identity and the confidentiality of the provided information. Respondents completed the questionnaires in face-to-face with the presence of the researcher and were given enough time to do the task.

Construct Measurement

Items that have been validated by previous research were adapted here to suit the needs of the local context (Rouibah et al., 2009) and used in the survey instrument: Five items for top management support from Lee and Kim (1992), four items for availability of training from Igbaria et al. (1995), four items for end-user's involvement from Franz and Robey (1986), five items for information quality from Doll and Torkzadeh (1988), four items for PEOU from Davis (1989), five items for PU from Davis (1989), three items for IS usage from Franz and Robey (1986), and four items for end-user's satisfaction from Rouibah et al. (2009).

The survey was developed in English and it was translated into Arabic and then back translated to English following well known procedure (Lowry et al., 2011) by a researcher who is expert in both English and Arabic. To check the cleanliness, reliability and validity of the measurement items, the instrument was pretested by two different samples. In the first pretest, it was validated by three IS professors in a leading public business school in Kuwait. In a second pretest, a pilot study was conducted by distributing the questionnaire to 50 end-users from four public ministries, representing 13.5% of the target population of organizations. The results of the pilot tests were acceptable in terms of reliability and validity. Based on their results, some items of the questionnaire were revised where a number of items were dropped, and others were rephrased. Some modifications were carried out to further enhance the clarity and comprehensibility of some items. The pilot sample was excluded from the final survey.

The Likert five-point scale was used ranging from (1) strongly disagree to (5) strongly agree. The questionnaire included two sections. The first one contained demographic data (gender, age, education level, and management level occupation, experience of end user with their organizations by number of years), age of IS applications in department / organizations (in number of years). The second section required respondents to state the extent to which they agree or disagree about items and measures in the research model.

Participants

Questionnaires were distributed randomly to participants who belong to 31 public-budget organizations according to the classification of organizations in Kuwait (Rouibah et al., 2009). Out of the 600 distributed surveys, only 526 usable and completed surveys were received and ready for our data analysis. The response rate is 87.6%. Table 1 displays the profile of the different respondents. 38.21% of the respondents are male and 61.78% are female. The majority of respondents (44.86%) are young

Table 1. Profile of respondents and s-commerce behavior (n=526)

Measure	Item	Percentage	Measure	Item	Percentage
Gender	Male	201 (38.21%)	Experience of end user	1-5	294 (55.89%)
	Female	325 (61.78%)		6-10	111 (21.10%)
Age	20-29	236 (44.86%)		11-15	82 (15.96)
	30-39	203 (38.78%)		16-20	21 (4.18)
	More than 40	86 (16.53%)		More than 20	15 (2.85)
Education level	Secondary or less	98 (18.63%)	Age of the system	1-5	163 (30.98%)
	Diploma	203 (38.59%)		6-10	114 (21.67%)
	University degree	199 (37.83%)		11-15	82 (15.68%)
	Graduate education	26 (4.94%)		16-20	70 (13.30%)
Job position	Top management	11 (2.7%)		21-25	46(9%)
	Middle management	90 (22.3%)		More than 26	51 (9.70)
	Operation management	302 (57.4%)			

and belongs to the age-group between 20 and 29 followed by 30-39. Most respondents are employees (57.4%) followed by managerial positions (22.3%). Many respondents are well educated (76.7%) and have either a diploma degree (2 years at the university) or a bachelor's degree. More than half of the participants (55.89%) have been working in their department/organization between 1 and 5 years and more than one third of the respondents (37%) have spent between 5 and 15 years. Finally, 31% of the IS in use have existed for less than 5 years while 21% existed between 6 and 10 years.

ANALYSIS AND RESULTS

Data analysis was performed using the SPSS in combination with SEM tool LISREL.

Principal Components Analysis

Since the research model included 8 constructs and 34 item measures, we conducted factor analysis to help find problematic items. Guided by Hair et al. (1998) results revealed the existence of only six factors aligned with their corresponding constructs and accounted for 71.90% of the variance explained which is acceptable and no items have cross-loadings above the standard maximum cut off 0.4 and all factors had Eigen values above 1.0.

From Table 2, the factor loadings, which are indicators of the degree of relationship between a construct and their items, are highly significant. Of the 34 items that were hypothesized to load on 8 variables were loaded only on 6 variables. All items loaded obviously on their related constructs, except 3 items were deleted (EUI4, PEOU3 and PEOU4) while items from PEOU, and PU, and actual use loaded together on IS usage. Further investigation revealed that respondents couldn't distinguish between these three constructs (PU, PEOU and Use). However, these items that measure the new current-usage of IS corroborating with the literature of IS (Doll & Torkzadeh, 1998). Accordingly, we switch the validation model from Figure 1 to Figure 2. As shown in Table 2, the variance explained also illustrates how much each new factor-construct explain.

Table 2. Measures, loadings, mean, SD, Cronbach α , C.R. and AVE

Construct Label	Item Label	Number of Items Delete	Factor Loading	Cronbach' α	Variance Explained	CR	AVE
Top management Support [TMS]	TMS1: The management encourages me using the system	0	0.676	96.2%	11.7%	0.897	0.636
	TMS2: The organization provides all necessary resources to improve the system		0.770				
	TMS3: The management discusses problems regarding the system		0.757				
	TMS4: My manager appreciates the optimal use of the system to meet its goal		0.683				
	TMS5: The management has a sufficient knowledge of the information system		0.609				
Availability of training [AT]	AT1: Organization offers training programs regarding our application	0	0.834	93.0%	10.9%	0.939	0.795
	AT2: Training programs and end-users roles are clear		0.840				
	AT3: Training material are available during training		0.834				
	AT4: I have technical support after training		0.648				
End-user involvement [EUI]	EUI1: I am involved in input design	1	0.892	91.1%	7.8%	0.972	0.945
	EUI2: I am involved in output design		0.892				
	EUI3: The management matters to me		0.536				
Information Quality [IQ]	IQ1: The information provided by the system is accurate	0	0.703	94.3%	14.4%	0.946	0.799
	IQ2: I get the information from the system on time		0.759				
	IQ3: The system provides complete information I need to address my tasks		0.790				
	IQ4: The system provides relevant information to me to tackle the tasks at hand		0.742				
	IQ5: The system provides up-to-date information		0.752				

continued on following page

Table 2. Continued

Construct Label	Item Label	Number of Items Delete	Factor Loading	Cronbach' α	Variance Explained	CR	AVE
Actual Use	PEOU1/ Use1: I find the system flexible to interact with	2	0.577	95.0%	27.1%	0.949	0.823
	PEOU2/ Use2: It is easy to become skillful at using the system		0.656				
	PU1/Use3: Using this system improves my performance		0.756				
	PU2/ Use4: Using this system increases my productivity		0.789				
	PU3/ Use5: The system enables me to accomplish tasks more quickly		0.788				
	PU4/Use6: I would find the system useful to my job		0.808				
	PU5/Use7: The system supports critical aspects of my job		0.774				
	Use1/Use8: The system helps me to perform my job better		0.803				
	Use2/Use9: Actual use of the system meets my expectations		0.723				
	Use3/Use10: Outputs and reports from this system are fully utilized		0.618				
End-user Satisfaction (EUS)	EIS1: I am satisfied with system outputs	0	0.692	87.4%	8.4%	0.957	0.717
	EIS2: I am satisfied with system accuracy		0.547				
	EIS3: I am satisfied with response time of the system		0.661				
	EIS4: Generally, I am satisfied with this system		0.695				

Construct Validity, Reliability and Common Bias Method

Before checking the path analysis of the research model, we first tested the model for convergent validity, discriminant validity and common bias method.

Convergent validity is the basic idea that measurement items that should be related are related. We used two approaches to assess convergent validity. First, we retained individual items with factor loading coefficients above the minimum standard of 0.4 (Hair et al., 1998), and results of factor loadings

Figure 2. New research model after factor analysis

in Table 2 vary from 0.536 to 0.892 which are within the acceptable range. Second, we estimated the average variance extracted (AVE), a measure of reliability of the constructs (Hair et al., 1998), that reflects the overall amount of variance accounted for by the items. AVE for each construct needs to be higher than 0.5 (Fornell and Larcker 1981; Hair et al., 1998), and values in table 2 (AVEs vary from 0.634 to 0.945) shows acceptable since.

Discriminant validity is usually assessed by testing whether the items associated with a construct (factor) correlate more highly with each other than with items associated with other constructs (factors) in the research model. We also used four approaches to examine discriminant validation of our research instrument. First, Cronbach's alpha coefficients indicate that each construct exhibits strong internal reliability (all above 0.70). Second, composite reliability (CR) is a more rigorous reliability measure and refers to the extent to which a variable or a set of variables is consistent in what it is intended to measure (Hair et al., 1998). Values of CR in Table 2 vary from 0.896 to 0.97 and thus higher than 0.70 required in social sciences (Fornell and Larcker 1981) which are evidence of construct reliability. Third, the shared variance (r^2) among variables, obtained by squaring the correlations (r), in Table 3, is less than the values of AVE (see Table 2). Fourth, discriminant validity is achieved when the

Table 3. Correlation matrix of principle constructs [cells values refer to r]

Constructs	1	2	3	4	5
1- Management Support					
2- Training	0.68				
3- User Involvement	0.56	0.52			
4- Information Quality	0.56	0.51	0.42		
5- Actual Use	0.66	0.56	0.44	0.76	
6- Satisfaction	0.65	0.57	0.45	0.80	0.88

square root of the AVE for a construct is higher than the variance shared between the construct and other constructs in the research model (Fornell and Larcker 1981). Table 2 shows the square root of the AVE for each construct is above 0.636 (values vary from 0.634 to 0.945), which is higher than the correlations between each pair of constructs.

Common method bias took place when variations in participant’s responses are caused by the research instrument (here the questionnaire) rather than the actual dispositions of the respondents that the instrument attempts to uncover. Thus, the instrument introduces a bias, which needs to be analyzed and removed if it exists. If not removed data results are affected by the biased instruments.

Since this study used a combination of SPSS and LISREL, then we tested common method bias using the Harman’s single factor score (Malhotra et al., 2006; Podsakoff et al., 2003; Sharma et al., 2009). This method allows to estimate if all items (measuring latent variable) are loaded into a single common factor. Common method bias is absent and does not affect collected data if the total variance for a single factor is less than 50%. As can be seen from Table 2 our analysis revealed that all the items can be categorized into six factors that the variance explained of these factors have values less than 50%. Therefore, the findings show that common method bias was not an issue for this study, and our research instrument is valid, reliable, reflects factor unidimensionality and ensures convergent validity.

The Model Fit

We used LISREL to validate the research hypotheses and we estimated the fit indices. The final model (see Table 4) shows a converged and a reasonably fit index which indicates a good fit to the data ($\chi^2 = 712.5$, $\chi^2/DF = 2.5$, GFI 0.79, AGFI = 0.74 and RMSEA 0.054, see Hair et al., 1998).

Table 4. Goodness of fit indices for the SEM model

Goodness of Fit	χ^2 (DF=2.5)	χ^2 /DF	GFI	AGFI	RMSEA
Requirements	-	<=3	≈ 0.90	>0.80	<=0.08
SEM model	712.5 (285)	2.5	0.79	0.74	0.054

The Structural Equation Modeling and Results

Figure 3 and Table 5 report the path coefficients (betas, β s) among variables of the research model, the t -values for each path, and significance of hypotheses. Of the 17 initial hypotheses, seven (07) associations were verified (after elimination of hypotheses related to PU and PEOU) and were significant. These are H1a, H1d, H2a, H3a, H4b, H2e, and H6. However, the remaining hypotheses were insignificant.

Figure 3. Final validated model

Table 5. Estimated direct and indirect path coefficients and their significance

Hypotheses Number	Direct Path Between Constructs	Path Coefficient	S.E Standard Errors	t-Value	p-Value	Significant
H1a	Top management support → quality	0.35	0.07	5.35	0.000***	S
H1d	Top management support → Use	0.30	0.05	5.72	0.000***	S
H1e	Top management support → Satisfaction	0.06	0.04	1.52	0.064	NS
H2a	Availability of Training → Quality	0.21	0.06	3.44	0.000***	S
H2d	Availability of Training → Use	0.07	0.05	1.56	0.059	NS
H2e	Availability of Training → Satisfaction	0.03	0.04	0.94	0.173	NS
H3a	User involvement → Information quality	0.11	0.05	2.15	*0.015*	S
H3d	User involvement → Use	0.00	0.04	-0.10	0.539	NS
H3e	User involvement → Satisfaction	0.02	0.03	0.77	0.220	NS
H4b	Information Quality → Use	0.57	0.05	11.78	*0.000	S
H2e	Information Quality → Satisfaction	0.28	0.04	6.73	*0.000	S
H6	Actual Use → Satisfaction	0.60	0.05	11.49	*0.000	S
Hypotheses Number	Indirect Path Between Constructs	Path Coefficient (β)	S.E Standard Errors	t-Value	p-Value	Significant
H1d	Top management support → Use	0.20	0.04	5.05	*0.000	S
H1e	Top management support → Satisfaction	0.40	0.05	7.53	*0.000	S
H2d	Availability of Training → Use	0.12	0.04	3.30	*0.000483	S
H2e	Availability of Training → Satisfaction	0.17	0.05	3.72	*0.0001	S
H3d	User Involvement → Use	0.06	0.03	2.12	*0.017003	S
H3e	User Involvement → Satisfaction	0.07	0.04	1.71	0.121	NS
H4c	Information Quality → Satisfaction	0.34	0.04	9.49	*0.000	S

*Path is significant at 0.05 level; **Path is significant at 0.01; *** Path is significant at 0.001

According to Table 5, information quality is determined by three external variables (top management support, availability of training and end-user involvement). Among these three factors top management support ($\beta = 0.33$) exerts the strongest effect followed by availability of training ($\beta = 0.21$) and end-user involvement ($\beta = 0.11$), respectively. These three variables contribute to explaining 60% of the variance of information quality. While Khalil and ElKordi (2005) has found that end-user involvement is directly related to information quality of IS executive use in Egypt, this is the first study that found that three variables are directly associated with information quality and therefore extending the finding of Rouibah et al. (2009) and Khalil and ElKordi (2005) with new insights.

System use is directly determined by two variables: information quality ($\beta = 0.57$) and top management support ($\beta = 0.30$), and notably, the effect of information quality is stronger than that of top management support. Use is also indirectly determined by three external variables: top management support ($\beta = 0.20$), availability of training ($\beta = 0.12$) and end-user involvement ($\beta = 0.06$). The indirect effect of top management support among the three variables is the strongest. These variables contribute to explaining 45% of the total variance in system use. The indirect effect of the three organizational factors support previous findings (Igbaria et al., 1995; 1997; Anandarajan et al., 2002) while the effect of information quality is in line with previous studies that tested Delone and McLean 2003 (Dwivedi et al, 2013; Ou et al., 2016) and extend the findings of Rouibah et al. (2009) with new insights.

Finally, end-user satisfaction is directly determined by two variables: information quality ($\beta = 0.28$) and system use ($\beta = 0.60$) where the effect of system use is found to be the strongest. End-user satisfaction is also indirectly determined by three variables: top management support ($\beta = 0.40$), information quality ($\beta = 0.34$), and availability of training ($\beta = 0.17$). Among these variables, top management support exerts the strongest effect. And these variables contribute to explaining 56% in the total variance of end-user satisfaction. Thus, our findings support previous studies that found the indirect effect of the three exogenous and organizational factors on end-user satisfaction (Rouibah et al., 2009), the direct effect of IS use on end-user satisfaction (Khalil and ElKordi, 1999; Khalil and ElKordi, 2005) as well as those studies that tested D&M model and found information quality to be positively related to end-user satisfaction (e.g. McGill et al., 2003; Nelson et al., 2005; Almutairi and Subramanian 2005; Dwivedi et al., 2013; Al-Debei et al., 2013; Rouibah et al., 2015). But our results contradict findings of some studies that found that end-user involvement has direct effect on end-user satisfaction (Santos et al., 2005). One possible explanation is the context since our study focused on public organizations while Santos et al. (2005) focus is on private organizations.

In summary, information quality seems to be an important mediator factor that mediates the effect of three organizational and exogenous variables (top management support, availability of training and end-user involvement) on system success (current use and end-user satisfaction) when using IS. Accordingly, this study succeeds, for the first time, to improve and extend the previous model of Rouibah et al. (2009) as well as other previous studies that were the basis of Rouibah et al. (2009) including (Igbaria et al., 1995, 1997; Anandarajan et al., 2002) and those that focused only on the relationship between use and satisfaction (Khalil and El Kordi, 1999). Also, our study is the first that extends the D&M model to include three organizational factors as antecedents of information quality.

This study found that items used to measure PU and PEOU were merged with the current use and this result does not contradict with previous studies. In fact, Doll and Torkzadeh (1998) reviewed past studies and established how IS-use was implemented in both lab and field studies and they found that these studies have used different measures, as those used by our study.

Finally, the insignificance of PU and PEOU on current IS-use is in line with the few studies that tested TAM. In fact, the review by Legris et al. (2003) who investigated the relationship between the TAM variables and actual usage found, in their review of 22 studies, that direct relationships between PEOU and PU and actual usage were not always recorded. PU was not associated in five cases while PEOU was not associated in five cases “by” PU and PEOU were not associated in five cases.

CONCLUSION

Research Contributions

This study has achieved four main research contributions. First, it extended the previous models that focused either on antecedents and organizational factors of system usage (Igbaria et al., 1995; 1996; 1997), antecedents and organizational factors of system usage and satisfaction (Al-Gahtani 2004; Anandarajan et al., 2002; Rouibah et al., 2009) and IS success (Delone and McLean 2003; Almutairi and Subramanian 2005; Dwivedi et al., 2013, Rouibah et al., 2015) by three external stimuli to current use and end-user satisfaction through the mediation, for the first time, of information quality. In addition, our study is the first that tries to reconcile DeLone and McLean (2003) with TAM through the addition of three external factors. This model links three external factors (end-user involvement, top management support and availability of training) to information quality to beliefs of TAM (PU and PEOU) to IS success constructs to show the role played by information quality in IS success. Second, this model was validated in a new and Arab context (Arab country and a new culture) represented here by Kuwait that received little attention by western researchers and many western scholars called for caution when applying western theories in other contexts (McCoy et al., 2007). And following Hong's et al. (2014) recommendations this study shows how contextualization of the combination of

information system success and TAM (western theories) was achieved since perceived usefulness and perceived of use were deleted. Third, this model showed the most factors that affected information quality, system usage and end-user satisfaction in public sector organizations, while the literature was found to focus on private companies (Igbaria et al., 1995; 1996; 1997; Al-Gahtani 2004; Anandarajan et al., 2002; Rouibah et al., 2009). Also, this study extended the information quality of Delone and McLean (2003) model since it is the first study that factored it as an endogenous variable and not as an exogenous variable as opposed to most previous studies (McLean and Delone 2003; Almutairi and Subramanian 2005; Floropoulos et al., 2010; Al-Debei et al., 2013; Dwivedi et al., 2013; Rouibah et al., 2015; Ou et al., 2016). Fourth, as opposed to previous studies (Igbaria et al., 1995; 1996; 1997; Al-Gahtani 2004; Anandarajan et al., 2002; Rouibah et al., 2009), our results failed to find the role played by TAM constructs (PU and PEOU) as mediators between external factors and IS success when quality attribute is involved, which may be call for caution when applying western theories in other context (McCoy et al., 2007; Hong's et al. 2014). One potential explanation for such lack of effect is the context of our study since the focus was on public organizations and not private which call for more studies to shed light on this issue. Fifth, validation of models in other contexts and cultures are still considered open issues in the information system field. Western researchers have called for caution when applying behavioral theories in other contexts (McCoy et al., 2007; Hong et al., 2014), while other provided methodologies to apply such contextualization. We followed Hong et al. (2014) and contextualized a new model for information system usage and success in two unique contexts (Arab context and public organizations context), which were not the focus of much studies. Last, the findings of this study could provide unique insights for both researchers and professionals to better understand the role played by antecedents to IS success and to suggest ways to increase IS success in public institutions.

Research Limitations

This study suffers from two limitations that may influence the degree to which its findings can be generalized. First, the respondents belong to a high-power distance culture where people respect others and cannot say no publicly when they are requested for a specific service. As the participants were solicited in face to face meetings to fill the questionnaire there was a possibility that some of them have filled their questionnaire just to please without giving enough care to state their actual opinions. Second, there is the probability that some answers of the respondents actually reflected their ideals of how things should be, rather than actual practices.

Management and Research Perspectives

From a management perspective, several managerial implications can be advocated for IS/IT practitioners. First, this study offers a comprehensive model for public organizations on how to increase IS success (use and satisfaction) and which factors may have strong impact on such success when they acquire or develop new information systems. Second, this model can be used to improve information quality in public organizations. Besides using traditional practices such as quality management practices, and application of performance standards for system development activities as was advocated by other researchers (Ravichandran and Rai, 2000; Gorla et al., 2010) this study also suggests three factors that increases information quality (including high management leadership, making necessary trainings, and involvement of end-users during all phases of information system development and acquisitions). Third, higher quality of information leads to an increase in information use and satisfaction. This finding indicates that a high quality of information provided on reports increases the possibility of greater use and satisfaction of information systems by end-users, and thus increases the chance to increase return of investment of acquired systems. Therefore, in order to foster greater use and satisfaction, managers in charge of information systems need to ensure that the reports' content provided is of high quality. Fourth, public sector organizations need to provide training programs for their employees aiming at improving end-user IS knowledge with respect to

information quality attributes (accuracy, timeliness, completeness, relevancy, and currency). Fifth, top managers should set adequate strategies for IS development, software procurement and IS training for end-users and ensure how organization can maximize their return of IS investments through high quality reports. They need also to support and be involved in setting priority educational and training programs that emphasis ISs benefits and quality reports, encourages more IS-use and automation of processes, reward employees and make sure that end-users are involved in IS development from the beginning. Organizations fail to recognize these factors identified in this study, risk of having a less usable IS system.

From a research perspective, this study encourages future studies to focus on the follow three directions: first, this study suggests improving the model by including new constructs, e.g., perceptions of co-workers about the usability and benefits they got from available trainings, and whether these group perceptions may influence their individual perceptions. Second, to include the two missing quality attributes (system quality and service quality) as two additional mediators besides information quality to link this study to Delone and McLean (2003) success model and thus continue to enrich the previous models (Igbaria et al., 1995, 1997; Anandarajan et al., 2002; Rouibah et al., 2009). Third, this study also suggests applying the model in all members of the Gulf Cooperation Council (GCC) countries to improve the IS success across its six Arab countries members and that share the same values. Fourth, this study also encourages conducting future longitudinal studies about the availability of end-training in pre- and post- adoption with the inclusion of the expectation and confirmation theory. Indeed, according to Karahanna et al. (1999) longitudinal studies across times and different sections (end-users, different departments, and different management levels) may provide more insightfulness on the realistic potential impact of IT training and support.

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ENDNOTES

- ¹ Shaikh and Karjaluoto (2015) concluded that “Among the most frequently investigated regions were East Asia and North America, and few studies applied IS/IT in Middle East and Arab region (2%)

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