

DEVELOPING AN EXTENDED TECHNOLOGY ACCEPTANCE MODEL: DOCTORS' ACCEPTANCE OF ELECTRONIC MEDICAL RECORDS IN JORDAN

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ABSTRACT. The purpose of this study is to construct doctors' acceptance model of Electronic Medical Records (EMR) in private hospitals. The model extends the Technology Acceptance Model (TAM) with two factors of Individual Capabilities; Self-Efficacy (SE) and Perceived Behavioral Control (PBC). The initial findings proposes additional factors over the original factors in TAM making Perceived Usefulness (PU), Perceived Ease Of Use (PEOU), Behavioral Intention to use (BI), SE, and PBC working in incorporation. A cross-sectional survey was used in which data were gathered by a personal administered questionnaire as the instrument for data collection. Doctors of public hospitals were involved in this study which proves that all factors are reliable.

Keywords: Electronic Medical Recors (EMR), Technology Acceptance Model (TAM),

INTRODUCTION

EMR is defined as "an electronic patient record that resides in a system specifically designed to support users by proving accessibility to complete and accurate data, alerts, reminders, clinical decision support systems, links to medical knowledge, and other aids" (Institution of Medicine (IOM), 1997). It offers several benefits such as improving efficiency, productivity and effectiveness of work. Despite the benefits of using Information System (IS) in an organization, IS users' resistance is a common problem in many industries including healthcare (Daim, Tarman, & Basoglu, 2008).

Acceptance studies related to technology adoption in the healthcare domain have been conducted in various countries in which most studies show that doctors' acceptance over the EMR were low (DesRoches et al., 2008). Some factors were identified causing the low acceptance on the technology by doctors, which lead healthcare organizations not to adopt EMR systems (DesRoches et al., 2008). The factors include lack of computer self-efficacy which refers to the ability to use computers in the accomplishment of a task (Aggelidis & Chatzoglou, 2009) and lack of perceived behavioral control which refers to the confidence in the ability to perform a task (Yi, Jackson, Park, & Probst, 2006).

In relation, Dillon and Morris (1996) defined user acceptance as "*the demonstrable willingness within a group to employ information technology for the tasks it is designed to support*". Moreover, it was found that studies on user acceptance of healthcare systems regarding healthcare managers and professionals' perceptions have affected the healthcare system implementation's success (Kijisanayotin, Pannarunothai, & Speedie, 2009).

Also, there are some theoretical models introduced to study user acceptance of IS implementation. Some of the famous theories are Theory of Reasoned Action (TRA) (Davis, Bagozzi, & Warshaw, 1989), Theory of Planned Behavior (TPB) (Ajzen, 1991), Technology Acceptance Model (TAM) (Davis, et al., 1989), and Social Cognitive Theory (SCT) (Bandura, 1986).

TAM; as seen in Figure 1; was proposed by Davis in 1989 after adopted from the TRA to predict and explain user's acceptance and rejection of computer-based technology. It was attempted to provide a basis to study the effect of external variables on user behavior by identifying some basic variables as determinants of computer acceptance.

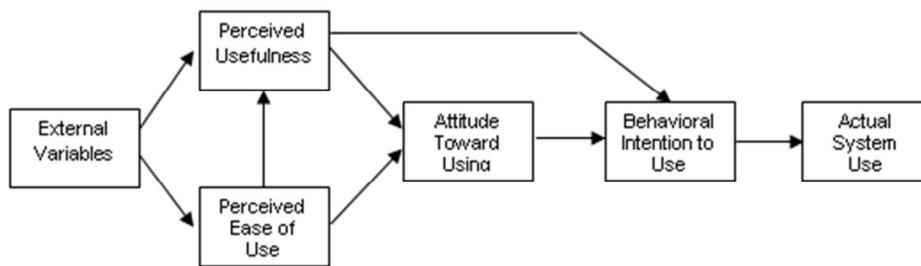


Figure 18. Technology Acceptance Model (Adopted from Davis et al. (1989)).

TAM suggests that PU and PEOU are particular beliefs acting as the determinants of computer acceptance behaviors. According to TAM, there are external variables influencing PU and PEOU. In addition, PU is also influenced by PEOU, and both determine the person's attitude towards using the system (ATT). This ATT with PU determine the BI which in turn determines the actual system use (Davis, et al., 1989).

Findings in previous works also indicate that SE and PBC can influence PU, PEOU, and BI. Therefore, it can be concluded that the factors are relevant to determine doctors' BI to use EMR in their daily work. In particular, (Davis, et al., 1989) clearly defines BI, PU, and PEOU. Shortly, BI is defined as *"the strength of one's intention to perform a specified behavior"*, while PU refers to *"the degree to which a person believes that using a particular system would enhance his or her job performance"*. While, PEOU is *"the degree to which a person believes that using a particular system would be free of effort"*.

On the other hand, the SE factor is originated from SCT. Bandura (1986) defined SE as *"people's judgments of their capabilities to organize and execute courses of action required to attain designated types of performances. It is concerned not with the skills one has but with judgments of what one can do with whatever skills one possesses"*. Then, Compeau and Higgins (1995) adopted the SE factor into their technology adoption study and defined this factor as *"an individual's perception of his or her ability to use a computer in the accomplishment of a job task"*. Meanwhile, PBC factor is originated from TPB. Ajzen and Madden (1986) defined PBC as *"a person's estimate of how easy or difficult it will be for him or her to carry out the behavior"*. In short, both SE and PBC refer to individual's beliefs that they are capable of performing a given behavior (Tavousi et al., 2009).

Therefore, doctors' BI to use EMR can be measured by PU, PEOU, SE and PBC. Hence, this paper aims to develop doctors' acceptance model by extending TAM specifically by adding SE and PBC as individual capabilities perspective factors.

LITERATURE REVIEW

The robustness of TAM has been tested in the healthcare application domain. Many studies can be found in the literatures that utilize an enhanced version of TAM, depending on the technology being studied. **Error! Reference source not found.** lists previous studies utilizing TAM in healthcare, which tested the main factors of TAM; PU, PEOU and BI to use.

These studies tested the technological and behavioral perspectives, in addition to the SE from the individual capabilities perspective.

Table 8. Summary of TAM in Healthcare - PU, PEOU, BI and SE.

Author	Technology	Country	Respondent	Findings (Significant = Sig / Non-Significant = Non-Sig)		
				Relation	Independent Factor	Dependent Factor
(Park & Chen, 2007)	Smart phone	USA	Doctors, Nurses, and Healthcare providers	Sig	PEOU	PU
				Sig	SE	PEOU
				Sig	PU	BI
				Sig	SE	BI
(Aggelidis & Chatzoglou, 2009)	IT in hospitals	Greece	HIS users: Medical, Nursing, and Administrative	Sig	PEOU	BI
				Sig	PU	BI
				Sig	SE	BI
				Sig	SE	PEOU
				Sig	PEOU	PU
(Johnston & Warkentin, 2008)	IS	USA	Professionals	Sig	SE	BI
(Wu, Wang, & Lin, 2007)	Mobile systems	Taiwan	Physicians, Nurses, Technicians	Sig	PEOU	PU
				Sig	SE	PEOU
				Sig	SE	PU
				Sig	PU	BI
				Sig	PEOU	BI

In contrast, Table 9 lists the studies of TAM in healthcare, which tested the main factors of TAM; PU, PEOU and BI. These studies tested the technological and behavioral perspectives, in addition to the PBC from the individual capabilities perspective.

Table 9. Summary of TAM in Healthcare - PU, PEOU, BI and PBC.

Author	Technology	Country	Respondent	Findings (Significant = Sig / Non-Significant = Non-Sig)		
				Relation	Independent Factor	Dependent Factor
(Chau & Hu, 2002)	Telemedicine	Hong Kong	Physicians	Sig	PU	BI
				Sig	PBC	BI
				Non-Sig	PEOU	PU
(Yi, et al., 2006)	PDA	USA	Resident and faculty physicians	Sig	PU	BI
				Sig	PBC	BI
				Sig	PBC	PEOU
				Non-Sig	PEOU	PU
				Non-Sig	PEOU	BI
(Rawstorne,	Nursing IS	Australia	Nurses	Sig	PEOU	BI

Jayasuriya, & Caputi, 2000)				Sig	PEOU	PU
				Sig	PU	BI
				Sig	PBC	BI

Based on Tables 1 and 2, the studies show that SE and PBC have not been tested together with TAM factors in EMR domain especially in Jordan. Therefore, it can be concluded that doctors' acceptance model can be developed based on individual capabilities, technological, and behavioral perspectives. The literatures also show that SE and PBC might affect PU, PEOU and BI to use the application. Therefore, SE and PBC are two factors that can be integrated into an extended TAM as determinants of PU, PEOU and BI to use an EMR system. In fact it has been shown that the integration of different models can provide more understanding and explaining of individual technology acceptance model (Chau & Hu, 2002; Yi, et al., 2006).

Hence, user's acceptance factors can be classified into; individual capabilities, technological, and behavioral perspectives. In particular, the individual capabilities perspective consists of SE and PBC, while the technological perspective consists of PU and PEOU. In completion, the behavioral perspective consists of BI to use. These three user acceptance perspectives are used to develop the intended model.

In addition, researchers in many countries developed acceptance studies in various healthcare domains. However, in Biomedical Informatics domain, especially in Jordan, there is no specific model integrating the three user acceptance perspectives to explain doctors' acceptance of EMR in Jordan. Therefore, there is a need for this model because such model is necessary in supports of the recent widespread of EMR implementation.

METHODOLOGY

Based on the factors as identified and discussed in the previous section, the intended model was constructed and illustrated in **Error! Reference source not found.**

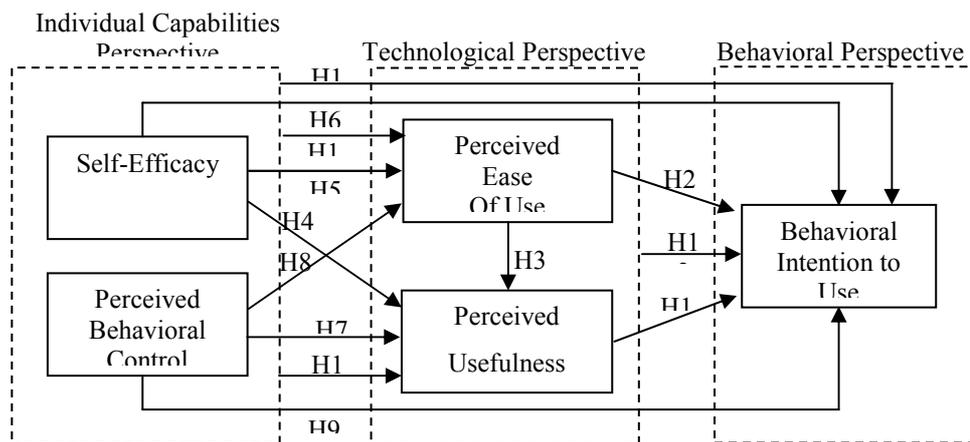


Figure 19. Research Model

As seen in the model in Figure 2, the following hypotheses were formulated to test the relationships between the observed factors:

- H1: PU has a direct effect on BI
- H2: PEOU has a direct effect on BI
- H3: PEOU has a direct effect on PU
- H4: SE has a direct effect on PU
- H5: SE has a direct effect on PEOU
- H6: SE has a direct effect on BI

- H7: PBC has a direct effect on PU
- H8: PBC has a direct effect on PEOU
- H9: PBC has a direct effect on BI
- H10: Individual Capabilities Composite Component has an effect on PU
- H11: Individual Capabilities Composite Component has an effect on PEOU
- H12: Technological Composite Component has an effect on BI
- H13: Individual Capabilities Composite Component has an effect on BI

After developing the research model and formulating relevant hypotheses, a questionnaire was designed based on the observed factors and measurement items. The measurement items were adopted from Davis (1989), Compeau and Higgins (1995), and Ajzen (2001).

A cross-sectional survey was used in this study in supports of hypotheses testing necessities. Data were gathered through personal administered questionnaires. Specialty Hospital (SH) and King Hussien Cancer Center (KHCC) were the targeted hospitals for employing doctors as the respondents. Altogether, the population is 187 doctors in KHCC and 52 doctors in SH. Based on the population size (239), 24 pilot questionnaires were distributed to test its' reliability and to make sure that the measurement item in the instrument is error-free (Sekaran, 2003). Response rate from the respondents were 100 percent. The results of the test showed that Cronbach's Alpha values for all factors are greater than 0.6. Therefore, all the factors are considered acceptable and reliable to be included in the questionnaire (Sekaran, 2003). In addition, the Cronbach's Alpha of the questionnaire is 0.853. The actual collected data will be analyzed using Simple and Multiple Linear Regression analysis using the statistical analysis tool SPSS version 18.0. Further, the results from the hypotheses testing will justify whether the tested factors can be included in the doctors' acceptance model.

CONCLUSION

As a conclusion, this study has proposed an extended TAM based on findings from previous works incorporating three perspectives; individual capabilities, technological, and behavioral perspectives. The model (as seen in Figure 2) can be used to predict doctors' acceptance of EMR in Jordan. The outcomes of the study are useful to the top management of healthcare organizations in preparing a strategic plan for EMR implementation, specifically focuses on doctors' awareness and readiness for EMR.

This study contributes to the theoretical knowledge of TAM. The proposed extended model consists of individual capabilities, technological, and behavioral perspectives as an enhancement for the original TAM, which consists of PU and PEOU in the technological perspective and BI in the behavioral perspective, by introducing SE and PBC from the individual capabilities perspective.

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