PDF version

Mohammadhiwa Abdekhoda,[1] Afsaneh Dehnad [2] and Javad Zarei [3]

[1]Department of Medical Library and Information Sciences, School of Management and Medical Informatics, Iranian Center of Excellence in Health Management (IceHM), Tabriz University of Medical Sciences, Tabriz, Islamic Republic of Iran. [2]Department of Foreign Languages, School of Health Management and Information Sciences, Iran University of Medical Sciences, Tehran, Islamic Republic of Iran (Correspondence to: Afsaneh Dehnad: afsanehdehnad@gmail.com; dehnad.a@iums.ac.ir). [3]Department of Health Information Technology, School of Paramedical Sciences, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Islamic Republic of Iran.

Abstract

Background: Electronic Medical Record (EMR) offers remarkable facilities such as reducing medical errors, decreasing healthcare costs and promoting quality of healthcare services by collecting, storing and displaying information at the point of care.

Aims: This study was carried out to identify the determinants of electronic medical record (EMR) adoption by presenting a comprehensive model.

Methods: This was a cross-sectional study in which 330 healthcare personnel working in hospitals affiliated to Tehran University of Medical Sciences, Tehran, Islamic Republic of Iran, were selected as the study sample. A proposed conceptual path model of technology, organization and environment (TOE), and technology acceptance model (TAM) was developed to identify the determinants of EMR adoption. The model was authorized by structural equation modeling (SEM) and represented by Analysis of Moment Structures (AMOS).

Results: The results of the study showed that the integrated model of TOE–TAM explained 68 percent (R2 = 0.68) of the variance of EMR adoption. The findings also evidenced that perceived ease of use, perceived usefulness, technological context, organization context and environmental context have significant effect on EMR adoption.

Conclusions: The study findings suggest that the proposed conceptual integrated model of TOE–TAM is a favourable model for identifying the relevant factors of EMR adoption. The present study clearly recognized nine significant determinants that affect end-users' intention when comprehensive implementation of ERMs is considered.

Keywords: electronic medical record, healthcare staff, technology acceptance model, technology organization and environment

Citation: Abdekhoda M; Dehnad A; Zarei J. Determinant factors in applying electronic medical records in healthcare. East Mediterr Health J. 2019;25(1):24-33. https://doi.org/10.26719/emhj.18.007

Received: 24/08/17; accepted: 26/02/18

Copyright © World Health Organization (WHO) 2019. Some rights reserved. This work is available under the CC BY-NC-SA 3.0 IGO license (https://creativecommons.org/licenses/by-nc-sa/3.0/igo).

Introduction

Electronic Medical Records (EMRs) are computerized health information systems that are set to alter the current largely paper-based medical records practice (1). EMR adoption is a significant issue when the system is used for collecting, storing and displaying information for the delivery of healthcare. Moreover, EMRs have appeared to be a vital tool for changing and transforming current healthcare services due to their potential benefits such as reducing medical errors, decreasing healthcare costs, and promoting quality of healthcare services (2,3).

Although it is widely believed that adoption of EMR can lead to improvement in clinical efficiency, the literature provides evidence concerning the failure of implementation of EMR due to end users' resistance (4). A wide variety of models have been established to develop an insight for elucidating and anticipating end-users' intention and supporting the main

determinants of information technology adoption (1,2,4–8). For example, a study was carried out by Gagnon et al. (2014) to identify the main determinants of physicians' acceptance of electronic healthcare records (EHRs), and found that the perceived ease of use and demonstrability had a significant effect on physicians' behaviour in EHR usage (9). However, much of these attempts have failed to present a comprehensive model for EMR adoption.

This study was conducted to revisit the current models and identify new determinants for EMRs adoption by extending the former model developed by researchers and presenting a new comprehensive model. This study was based on the integration and modification of two classical models: Technology, Organization and Environment (TOE) and Technology Acceptance Model (TAM). Effective factors in the adoption and perception of EMRs by healthcare staff were also addressed in this study.

Hypotheses of the study

Initially, TAM was developed by Davis et al. (1989) (10) in order to understand the process of accepting and adopting information technology. The model, in which Perceived Ease of Use (PEOU), Perceived Usefulness (PU), Attitude, and Usage were the main components, was then widely used to elucidate users' behavioural intention with respect to modern technology (10–12). This model shows that PEOU and PU affect attitude, while PU and Attitude together control usage (10). To address the main questions of the study, the following hypotheses, H1and H2 concerning PU and PEOU, were proposed as; H1: PEOU has a direct effect on EMRs adoption; and H2: PU has a direct effect on EMR adoption.

The TOE model, explaining the level of information system adoption and information technology products, was developed by Tornatzky and Fleischer (1990) (13). The TOE model, which is extensively used for information technology adoption (14), employs three main contexts: technological, organizational, and environmental context, and affecting new technology implementation (15). Relative advantages, compatibility and complexity – categorized under Technology context – seem to have a considerable effect on PU and PEOU. The literature shows relative advantages have direct and significant effects on the variables of TAM; i.e., PU and PEOU (1,13,16,17). Cucciniello et al. (2015) examined the interaction of sociological and technological factors in EMRs' implementation, and found that organizational, cultural, technological and financial considerations should be taken into consideration when comprehensive implementation of EMR is in progress (18). Regarding relative advantages, hypotheses H3 and H4 were proposed as; H3: Relative advantages have positive effects on PEOU; and H4: Relative advantages have positive effects on PU.

Compatibility is defined as "the degree to which an innovation is perceived as consistent with

the existing values, past experiences, and needs of potential adopters" (19). Given that several studies approve the positive and significant effect of compatibility on PU and PEOU, the following hypotheses were proposed (1,16,19,20) as; H5: Compatibility has a direct effect on PEOU; and H6: Compatibility has a direct effect on PU. There are a number studies acknowledging the negative role of complexity in information technology (IT) adoptions (1,13,21,22). Concerning complexity, the following hypotheses were proposed as; H7: Complexity has a negative effect on PEOU; and H8: Complexity has a negative effect on PU.

In the TOE model organizational competency, management support, and training and education are categorized as the organizational context. Regarding organizational competency, hypothesis H9 was proposed; H9: Organizational competency has a positive effect on PU.

The role of top management commitment and management support in development, implementation and adoption of new technology, have been addressed in several studies (5,13,23–25). Therefore, we made the following two hypotheses: H10: Management support has a direct effect on PEOU; and H11: Management support has a direct effect on PU. Training decreases the user's technophobia and stress, reduces ambiguity, provides motivation to apply new technology, and helps to better understand new technology adoption (13). Thus, hypotheses 12 and 13 were proposed to address this variable as follows: H12: Training and education has a positive effect on PEOU; and H13: Training and education has a positive effect on PU.

Finally, environmental context contains two main variables: competitive pressure and trading partner. Both variables impose an effect on adoption of EMR. Thus, hypothesis 14 was proposed as: H14: Competitive pressure has a positive effect on EMR adoption. In the system development life cycle (SDLC) 'support' is a main component and is known as conducting post-implementation system review, identifying errors and enhancements and monitoring system performance (26). In this study we investigated the effect of trading partner support on EMR adoption; thus, hypothesis 15 was proposed as: H15: Trading partner support has a positive effect on EMR adoption. Summary of hypotheses and proposed integrated model is presented in Figure 1 .

Methods

In this cross-sectional study, conducted in teaching hospitals of Tehran University of Medical Sciences (TUMS) from March to September 2016, a modified and integrated model of TOE and TAM was applied for understanding the determinants of EMRs adoption. The population of the study consisted of 1100 healthcare staff working in hospitals affiliated to TUMS. Although Tanaka (1987) has remarked that sample size is a controversial issue in structural equation

modeling (27), eight subjects were selected for each item on the basis of Schumacker and Lomax (2004). Stratified random sampling was then used and resulted in a sample of 330 physicians, nurses and medical records experts/ technicians and managers (28). Thereafter, the sample of the study was divided into four groups: physicians, nurses, medical record experts, and managers from each stratum of the study.

A questionnaire based on Gangwar et al. (2015) and Abdekhoda et al. (2016) (1,13) was developed for data collection (Table 1). The face validity of the questionnaire was confirmed by 10 faculty members of the school of Health management and Information Sciences, TUMS. Reliability analysis showed Cronbach α = 0.89, indicating that the data collection tool was reliable. The items of the questionnaire were framed on a five point Likert scale in which 'Totally agree', 'Agree', 'Neutral', 'Disagree' and 'Totally disagree' were assigned to test the items.

A correlation analysis was performed to identify the correlation coefficient of the variables. Also a graphical path model was adopted to test the hypothesis of the proposed model. The proposed conceptual path model (Figure 1) was developed and tested by using AMOS. In the path analysis, the path coefficients (β) and corresponding P-values were estimated and presented as the measures of the relationship. Finally, the authorized conceptual path model was presented. Survey questions used to measure the constructs of TOE–TAM are shown in Table 1
.

Results

From 330 questionnaires distributed, 278 were returned completed (response rate = 84.24%). Due to the inclusion of wrong information or only partially filled-out questions, 41 questionnaires were not suitable for analysis; thus, the final analysis was conducted for 237 questionnaires. Table 2
shows demographic information of the participants of the study.

The correlation between variables of the proposed integrated model is shown in Table 3 . As seen, there is a significant correlation between TAM variables, i.e., PEOU and PU, and the use of EMRs. Moreover, there is a significant correlation between technological context organizational context and environmental context and TAM variables (PU and PEOU) and the use of EMR.

Figure 2 indicates that PU and PEOU have a positive and significant effect on the EMRs'

adoption (β = 0.71, P ≤ 0.01; β = 0.49, P ≤ 0.01). Thus, relative advantage, compatibility, and complexity indicated positive and significant effects on both PU and PEOU. Figure 2 also indicates organizational competency has a direct and significant effect on PEOU (β = 0.21, P ≤ 0.01); and management support has a direct and significant effect on both PU and PEOU (β = 0.31, P ≤ 0.01; β = 0.27, P ≤ 0.01). However, training and education appeared to have a positive and significant effect on PEOU whereas no significant effect on PU was found. Finally, Figure 2 indicates that environmental context has a direct and significant effect on the adoption of EMR. These findings revealed altogether that technological context and organizational context explained 48% of the variance observed in PEOU, and 57% of the variance observed in PU. Furthermore, 68% of variance of EMRs adoption can be explained by the integrated model of TOE and TAM

Table 4 indicates the recommended goodness-of-fit measure. The ratio X2 was used to test whether the selected distribution was a good fit to the data. A relative X2 value appeared to be acceptable (Relative X2 = 1.02). Moreover, Tucker Lewis Index (TLI), Comparative Fit Indices (CFI), Normal Fit Index (NFI), and Relative Fit Index were measured and obtained values that were favourable.

Discussion

The results of the present study indicate that technological context, organizational context, and Environmental context as well as variables of TAM are important determinants when comprehensive implementation of EMR is considered.

Concerning the correlation between PEOU and PU on one side, and the adoption of EMRs on the other, the findings show PEOU have a direct and significant effect on EMRs adoption. Thus H1 was supported. Also, the findings revealed that PU had a strong effect on EMRs adoption; hence, H2 was supported. These findings are in line with the findings reported in the literature (1,14,19,20,29,30). It is believed that when comprehensive implementation of EMRs is considered, the personnel's interaction with EMRs should be clear and understandable, while the operation of EMR should be easy and navigation of such systems should be user friendly.

Concerning the association between relative advantages and PEOU, the standard coefficient of PEOU and adoption of EMRs was 0.27 (P = 0.01), supporting H3, and indicating relative advantages have positive and significant effect on PEOU. The standard coefficient of PU and EMRs adoption was 0.35 (P = 0.01), supporting H4. These findings are similar to the results of the studies carried out by Zhang (2008), Wu (2008), Conrad (2009), Ping (2009), Gangwar (2015) and Abdekhoda et al. (2015,2016), who reported that relative advantages have positive

and significant effect on PEOU and PU (1,13,16,17,23,24,31). This finding can imply that if EMRs adoption had no noticeable advantage for healthcare staff, its implementation would not be welcome.

As for the relationship between compatibility and TAM variables, the results show that compatibility has a positive and significant effect on PEOU and PU, supporting H5 and H6. Likewise, Rogers (2003), Chew (2004), Zhang (2008), Tung (2008) and Abdekhoda et al. (2016) found that compatibility had a direct and significant effect on TAM variables (1,16,19,20,32). When implementing EMR, we should consider whether it is well matched with the personal characteristics of healthcare staff and fits well into the workflow.

Regarding the correlation between complexity with PEOU and PU, complexity was found to have a negative and significant effect on PEOU and PU. Thus, H7 and H8 were supported. The literature has reported that complexity has a negative effect on implementation of new technology (1,17,26,29–31). The findings imply that when the adoption of EMR is accompanied with complexity, end users' tendency to apply this system decreases significantly.

The findings on the relationship between organizational competency and PEOU (Figure 2), suggest that organizational competency has a positive and significant effect on PEOU. Hence, H9 was supported, and supports Gangwar 2015 (13). Organizational competency is defined as "the institutional capacity or efficiency that is necessary to enable the organization to achieve the goal and objectives in its strategies plan" (33). Thus, for the successful implementation of EMRs, sufficient technological resources and allocation of a percentage of total revenue should be considered by healthcare organizations. Furthermore, the finding shows that management support has a positive and significant effect on both PEOU and PU. Thus, H10 and H11 were supported. Morton (2008), Kowitlawakul (2008), Wu et al. (2008), Gangwar (2015), and Abdekhoda et al. (2015) have reported a direct and significant path coefficient rate between management support and TAM variables (PU and PEOU) (5,13,23–25). The implementation of EMR should be considered as an imperative change for top managers and must be fully supported by them.

Concerning the effects of training and education on TAM variables (PEOU and PU), the results show that training and education have a positive and significant effect on PEOU, but they have no significant effect on PU. Hence, H12 was supported; whereas H13 was not supported. Similarly, Morton (2008) and Abdekhoda et al. (2015) found that training had no significant effect on PU (5,23). Other studies reported that training should be considered as an important determinant when successful implementation of new technology was followed.

Finally, the results show that environmental context, i.e., competitive pressure and trading partner support, have a positive and significant effect on EMRs adoption. Concerning the association between comparative pressure and EMRs adoption, the coefficient rate of 0.18 (P = 0.05) was obtained, indicating competitive pressure had a positive and significant effect on EMRs adoption; thus, H14 was supported. Similarly, Gangwar et al. (2015) found that when cloud computing was considered as a competitive instrument, pressure to adopt cloud computing and having a competitive edge were encouraged (13).

The findings also revealed that EMRs adoption was significantly driven by trading partner support. In EMRs adoption phases, trading partner support should provide technical assistance for EMRs services, while conducting post-implementation system review, identifying errors and enhancements and monitoring system performance should be taken into consideration. However, some limitations are noted in this study. Self-reported use of EMRs by healthcare staff (instead of monitoring the actual use of this system), self-selection biases in the process of completing the questionnaire, and limiting the population of this study to the teaching hospital of TUMS, were a number of the limitations that should be considered in upcoming studies. A summary of proposed results for the theoretical model are presented in Table 5.

Conclusion

This study was conducted to determine the significant factors that may affect EMRs adoption. To this end, two classical models of TOE and TAM were integrated and extended. The findings of this study suggest that the proposed integrated model of TOE and TAM is appropriate for identifying the relevant factors of EMRs adoption. The present study identified nine significant determinants that affect the end user's behaviour when comprehensive implementation of EMRs is considered. Overall, the findings show that the two main components of TAM, PEOU and PU act as mediating variables for external variables of the modified model. External variables of TAM, relative advantages, compatibility, complexity, organizational competency, management support, competitive pressure, and trading partner support appeared to have significant effects on EMRs adoption. Thus, in order to fulfill the implementation of EMR, a wide variety of factors such as perceived ease of use, perceived usefulness, technological context, organizational context and environmental context should be considered. Future studies should focus on the role of other factors such as personnel characteristics, security and confidentiality that may affect EMR adoption.

Funding: None.

Competing interests: None declared.

Facteurs déterminants de l’utilisation de dossiers médicaux électroniques dans les soins de santé

Résumé

Contexte : Les dossiers médicaux électroniques offrent des possibilités remarquables telles que la réduction du nombre d’erreurs médicales, la diminution des coûts de santé et la promotion de la qualité des services de soins de santé grâce à la collecte, au stockage et à l’affichage de l’information sur le lieu où sont prodigués les soins.

Objectifs : La présente étude a été menée dans le but d’identifier les déterminants de l’adoption de dossiers médicaux électroniques en recourant à une présentation d’un modèle complet.

Méthodes : Il s’agissait d’une étude transversale au cours de laquelle 330 personnels de santé travaillant dans les hôpitaux rattachés à l’Université de Sciences médicales de Téhéran (République islamique d’Iran) ont été sélectionnés pour constituer un échantillon d’étude. Un modèle conceptuel de type PATH (outil d’évaluation de la performance pour améliorer la qualité dans les hôpitaux) pour le cadre de technologie, organisation, environnement (TOE) et le modèle d'acceptation de la technologie (MAT) a été proposé et élaboré afin d’identifier les déterminants de l’adoption de dossiers médicaux électroniques. Ce modèle a été validé par la modélisation d'équations structurelles et représenté au moyen du logiciel de statistiques AMOS.

Résultats : Les résultats de l’étude ont montré que le modèle intégré TOE-MAT permettait d’expliquer 68 % de la variance (R2 = 0,68) de l’adoption de dossiers médicaux électroniques; ils ont aussi mis en évidence la facilité d’utilisation et l’utilité perçues, ainsi que le fait que les contextes technologique, organisationnel et environnemental avaient une influence importante sur cette dernière.

Conclusions : Les conclusions suggèrent que le modèle conceptuel intégré TOE-MAT proposé constitue un modèle utile pour l’identification des facteurs pertinents de l’adoption de dossiers médicaux électroniques. L’étude identifie également clairement neuf déterminants importants qui influent sur l’intention des utilisateurs finaux de mettre en place ce système de façon exclusive.

WHO EMRO | Determinant factors in applying electronic medical records in healthcare

العوامل المحددة لاستخدام السجلات الطبية الإلكترونية في مجال الرعاية الصحية

محمد هيوا عبدخدا، أفسانه دهناد، جواد زارعي

الخلاصة

: يوفّر السجل الطبي الإلكتروني تسهيلات ملحوظة، مثل الحدّ من الأخطاء الطبية،الخلفية وتخفيض تكاليف الرعاية الصحية، وتعزيز جودة خدمات الرعاية الصحية من خلال جمع المعلومات وتخزينها وعرضها في مكان توفير الرعاية .

: أُجريت هذه الدراسة لتحديد العوامل المحددة لاستخدام السجل الطبيالأهداف الإلكتروني من خلال عرض نموذج شامل .

: لقد كانت دراستنا مقطعية، حيث تم اختيار 330 عاملاً في مجال الرعاية الصحيةطرق البحث في المستشفيات التابعة لجامعة طهران للعلوم الطبية، طهران، جمهورية إيران الإسلامية، بمثابة عينة للدراسة . ووُضِع نموذج المسار المفاهيمي المقترح للتكنولوجيا والتنظيم والبيئة، ونموذج قبول التكنولوجيا بهدف تحديد العوامل المحدّدة لاستخدام السجل الطبي الإلكتروني . واعتُمد النموذج بواسطة نمذجة المعادلة الهيكلية، وتم تمثيله باستخدام تحليل الهياكل اللحظية .

: أظهرت نتائج الدراسة أن النموذج المتكامل للتكنولوجيا والتنظيم والبيئةالنتائ ج ونموذج قبول التكنولوجيا يوضح 68% (R2 = 0.68) من التباين في استخدام السجل الطبي الإلكتروني . كما أثبتت النتائج أن سهولة الاستخدام الملموسة والفائدة المتصورة والسياق التكنولوجي والتنظيمي والبيئي لهم تأثير كبير على استخدام السجل الطبي الإلكتروني .

: اقترحت نتائج الدراسة أن النموذج المتكامل المفاهيمي المقترحالاستنتاجات للتكنولوجيا والتنظيم والبيئة ونموذج قبول التكنولوجيا نموذج ملائم لتحديد العوامل ذات الصلة باستخدام السجل الطبي الإلكتروني . وحددت الدراسة الحالية بوضوح تسعة عوامل محددة مهمة تؤثر في مقصد المستخدمين النهائيين عندما يتم الأخذ في الاعتبار التنفيذ الشامل للسجلات الطبية الإلكترونية .

References

10 / 13

1. Abdekhoda M, Ahmadi M, Dehnad A, Noruzi A, Gohari M. Applying Electronic Medical Records in health care Physicians' perspective. Appl Clin Inform. 2016;07(02):341–54. http://dx.doi.org/10.4338/ACI-2015-11-RA-0165

2. Carayon P, Smith P, Hundt AS, Kuruchittham V, Li Q. Implementation of an electronic health records system in a small clinic: the viewpoint of clinic staff. Behav Inf Technol. 2009;28(1):5–20. http://dx.doi.org/10.1080/01449290701628178

3. Chaudhry B, Wang J, Wu S, Maglione M, Mojica W, Roth E, et al. Systematic review: impact of health information technology on quality, efficiency, and costs of medical care. Ann Intern Med. 2006;144(10):742. http://dx.doi.org/10.7326/0003-4819-144-10-200605160-00125

4. Boonstra A, Broekhuis M. Barriers to the acceptance of electronic medical records by physicians from systematic review to taxonomy and interventions. BMC Health Serv Res. 2010;10(1):231. http://dx.doi.org/10.1186/1472-6963-10-231

5. Morton ME. Use and acceptance of an electronic health record: factors affecting physician attitudes. [Retrieved From Proquest Dissertations And Theses Database. (Umi No. 3327272)]. Drexel University; 2008.

6. Abdekhoda M, Salih KM. Determinant Factors in Applying Picture Archiving and Communication Systems (PACS) in Healthcare. Perspect Health Inf Manag. 2017;14(Summer)

7. Sattari A, Abdekhoda M, Zarea Gavgani V. Determinant Factors Affecting the Web-based Training Acceptance by Health Students, Applying UTAUT Model. International Journal of Emerging Technologies in Learning. 2017;12(10):112–26. http://dx.doi.org/10.3991/ijet.v12i10.7258 [iJET]

8. Abdekhoda M, Dehnad A, Mirsaeed SJG, Gavgani VZ. Factors influencing the adoption of E-learning in Tabriz University of Medical Sciences. Med J Islam Repub Iran. 2016;30:457.

9. Gagnon M-P, Ghandour EK, Talla PK, Simonyan D, Godin G, Labrecque M, et al. Electronic health record acceptance by physicians: Testing an integrated theoretical model. J Biomed Inform. 2014;48:17–27. http://dx.doi.org/10.1016/j.jbi.2013.10.010

10. Davis FD. Perceived usefulness, perceived ease of use, and user acceptance of information technology. Manage Inf Syst Q. 1989;13(3):320.

11. Hong S, Thong JY, Tam KY. Understanding continued information technology usage behavior: A comparison of three models in the context of mobile internet. Decis Support Syst. 2006;42(3):1819–34. http://dx.doi.org/10.1016/j.dss.2006.03.009

12. Abdekhoda M, Ahmadi M, Dehnad A, Hosseini AF. Information Technology Acceptance in Health Information Management. Methods Inf Med. 2013;53(1):14–20. http://dx.doi.org/10.3414/ME13-01-0079

13. Gangwar H, Date H, Ramaswamy R. Understanding determinants of cloud computing adoption using an integrated TAM-TOE model. J Enterp Inf Manag. 2015;28(1):107–30. http://dx.doi.org/10.1108/JEIM-08-2013-0065

14. Zhu K. The complementarity of information technology infrastructure and e-commerce capability: A resource-based assessment of their business value. J Manage Inf Syst. 2004;21(1):167–202. http://dx.doi.org/10.1080/07421222.2004.11045794

15. Angeles R. Using the Technology-Organization-Environment Framework for Analyzing Nike's "Considered Index" Green Initiative, a Decision Support System-Driven System. J Manag Sustain. 2014;4(1):96. http://dx.doi.org/10.5539/jms.v4n1p96

16. Zhang N, Guo X, Chen G. IDT-TAM integrated model for IT adoption. Tsinghua Sci Technol. 2008;13(3):306–11. http://dx.doi.org/10.1016/S1007-0214(08)70049-X
17. Yu P, Li H, Gagnon M-P. Health IT acceptance factors in long-term care facilities: A cross-sectional survey. Int J Med Inform. 2009;78(4):219–29. http://dx.doi.org/10.1016/j.ijmedinf.2008.07.006
18. Cucciniello M, Lapsley I, Nasi G, Pagliari C. Understanding key factors affecting electronic medical record implementation: a sociotechnical approach. BMC Health Serv Res. 2015;15(1):268.
19. Rogers EM. Diffusion of innovations. 5th ed. New York: Free Press; 2003.
20. Tung F-C, Chang S-C, Chou C-M. An extension of trust and TAM model with IDT in the adoption of the electronic logistics information system in HIS in the medical industry. Int J Med Inform. 2008;77(5):324–35. http://dx.doi.org/10.1016/j.ijmedinf.2007.06.006
21. Ardis MA, Green JA. Successful introduction of domain engineering into software development. Bell Labs Tech J. 1998;3(3):10–20. http://dx.doi.org/10.1002/bltj.2112
22. Lee TT. Nurses' adoption of technology: application of Rogers' innovation-diffusion model. Appl Nurs Res. 2004;17(4):231–8.
23. Abdekhoda M, Ahmadi M, Gohari M, Noruzi A. The effects of organizational contextual factors on physicians' attitude toward adoption of Electronic Medical Records. J Biomed Inform. 2015;53:174–9. http://dx.doi.org/10.1016/j.jbi.2014.10.008
24. Wu JH, Shen WS, Lin LM, Greenes RA, Bates DW. Testing the technology acceptance model for evaluating healthcare professionals' intention to use an adverse event reporting system. Int J Qual Health Care. 2007;20(2):123–9. http://dx.doi.org/10.1093/intqhc/mzm074

25. Kowitlawakul Y. Technology Acceptance Model: Predicting Nurses' Acceptance of Telemedicine Technology (eICU®). 2008.
26. Piprani B, Borg M, Chabot J, Chartrand É, editors. An adaptable ORM metamodel to support traceability of business requirements across system development life cycle phases. OTM Confederated International Conferences" On the Move to Meaningful Internet Systems"; 2008: Springer.
27. Tanaka JS. How big is big enough?": Sample size and goodness of fit in structural equation models with latent variables. Child Dev. 1987;58(1):134–46. http://dx.doi.org/10.2307/1130296
28. Schumacker RE, Lomax RG. A beginner's guide to structural equation modeling. Psychology Press; 2004. http://dx.doi.org/10.4324/9781410610904
29. Völlink T, Meertens R, Midden CJ. Innovating 'diffusion of innovation'theory: Innovation characteristics and the intention of utility companies to adopt energy conservation interventions. J Environ Psychol. 2002;22(4):333–44. http://dx.doi.org/10.1006/jevp.2001.0237
30. Atkinson NL. Developing a questionnaire to measure perceived attributes of eHealth innovations. Am J Health Behav. 2007;31(6):612–21. http://dx.doi.org/10.5993/AJHB.31.6.6

31. Conrad ED. Willingness to use IT innovations: A hybrid approach employing diffusion of innovations and technology acceptance models: Southern Illinois University Carbondale; 2009.

32. Chew F, Grant W, Tote R. Doctors on-line: using diffusion of innovations theory to understand internet use. Fam Med. 2004;36(9):645–50.
33. Momeni M, Monavarian A, Shaabani E, Ghasemi R. A conceptual model for knowledge

management process capabilities and core competencies by SEM the case of Iranian automotive Industry. Eur J Soc Sci. 2011;22(4):473–89.

Thursday 11th of July 2024 07:53:48 AM