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FACTORS THAT DETERMINE EELECTRONIC MEDICAL RECORDS USERS SATISFACTION: A CASE OF INDONESIA

[1]TOGAR ALAM NAPITUPULU, [2]SURYANTO HASOLOAN JULHAM PATRIA

[1] Senior Lecturer, Bina Nusantara University, Indonesia
[2] Work as IT Business Application at PT.Charoen Pokphand Indonesia Tbk
E-mail: [1]tnapitupulu@binus.edu , [2]Suryanto.patria@gmail.com

ABSTRACT

The purpose of this study was to find factors that influence the level of user satisfaction of Elecronic Medical Records (EMR). Several factors were considered which are: the effectiveness of EMR systems *(performance expectancy)*, ease of use and learning system of EMR *(effort expectancy)*, the condition of facilities which facilitate EMR system *(facilitating condition)*, the quality of information provided by the system (*information quality)*, and culture organization *(sharing knowledge).* Three moderate variables were also introduced such as age, period of employment and expertise in using a computer. The research was carried out by taking samples from the hospitals that have implemented EMR in the country. The data obtained then was tested and analyzed using the framework of Structural Equations Modeling (SEM), to test the hypothesis in two steps, i.e., measurements modeling using *confirmatory factor analysis (CFA)* and structural modeling, using simultaneous linear regression. The findings of the study indicated that of the five factors in the test *(performance expectancy, effort expectancy, quality information, facilitating condition, sharing knowledge)*, were all have impact on the level of user satisfaction on EMR. Practical implications of the findings, among others, would be that these important factors should always be considered as element of strategy in developing better information systems.
Keywords: *Electronic Medical Records, User Satisfaction, SEM*

1. INTRODUCTION

Integrated system at the same time can be accessed in real time, is one IT strategy that is mostly pursued in several companies in order to speed up process performance, process automation and hence labor costs reduction, and ultimately should contribute to the bottom-line, i.e., the profit. Likewise, many health institutions such as hospitals that emphasize the quality of health services are following such strategy. EMR is a computer based information system that integrates patient-specific information from various sources, as well as providing the tracking facility of information from time to time for purposes of analysis and reporting. EMR in the United States has long been known implemented around the beginning of the 2000s; while in Indonesia alone EMR began implemented in 2000 and even then still a few hospitals that implement EMR in a comprehensive manner. Most hospitals that implement them are international hospitals.

With the implementation is not cheap certainly hope that emerges from these systems is very high. For example, to have the analysis of the patient's disease more quickly, to improve the effectiveness of time and energy, to reduce budget expenditures that are commonly used in a paper based medical record reports, and so forth, EMR is expected to provide. One indicator that can be used to measure the success rate of such information systems is by looking at the level of user satisfaction. It is therefore the objective of this research was to examine what factors are affecting the user satisfaction of the EMR and to find out the magnitude of each factor impact on the level of satisfaction.

2. LITERATURE REVIEW

EMR (Electronic Medical Records) is a computer based information system that integrates patient-specific information from various sources, as well as providing the tracking facility of the

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information from time to time for purposes of analysis and reporting, or it can also be regarded as records of medical from several sources, associated with patient care, diagnosis, laboratory tests, medical history, and recipes, which can be accessed from several different places within an organization in the security and privacy and confidentiality of the patient (Mohd & Mohamad, 2005). [1]. EMR is basically developed not only to speed up the decision making process of a physician in medical decision making, but also ensures convenience and comfort of patients, due to the integrated information system with unique identity, where the patient does not need to be bothered with a variety of files (Klehr et.all. , 2009). [20]. EMR also plays as a center of medical data to enable the withdrawal of the patient's health status information in a timely manner for its users and to document any medical treatment (Poissant, Pereira, Tamblyn, and Kawasumi, 2005). [22]. In addition to increasing the efficiency of time, EMR also provides increased storage of patient data, in a manner that data integrity is also ensured(Kochevar et al, 2011).[21].

Previous studies found several factors that influence user acceptance and satisfaction of the EMR. The first is the user's ability to use computer systems; it is becoming one of the obstacles or considerations for some hospitals to implement EMR (Alanazy Sultan, 2006).[2]. Laerum et al. (2003) [3] concluded that the low level of use of EMR systems is caused by a lack of availability of computers and the ability of users to use a computer.. Another factor to mention is that both the user interface design and quality of information also affects the level of acceptance of information systems in previous studies measuring satisfaction with the EMR in addition to user interaction that greatly influenced the design and layout of the screen (Sitting et al., 2000). The third factor is the network infrastructure which is the basic resource of all information systems (O'Brien, 2006:39).[17], The dependence on the network makes use of the system as a network issue that is often discussed when a company wants to implement new technologies (Corrocher & Fontana , 2007). [4]. Understanding the dynamics of the network effect becomes very important in this phase of the introduction of technology and strategy development (Ayers et al., 2009). [5] The fourth factor that is the culture (Seeman & Gibson, 2009). [8], Culture can increase consumer intentions to use technology (Bandyopadhyay, 2007). [9], EMR which is a form of organizational change that changes the conventional care system in the form of electronic services not only requires learning in the process of change but there is an organizational culture that affect individuals or groups working to better understand organizational change and improve the learning process (Lucas and Kline, 2008). [10].

Research on the acceptance or EMR system user satisfaction has been done in several countries, some of which are as follows:

Mohammed Al Farsi et.al. (2005) [1] conducted a study on measurement of physician satisfaction and the adoption of EMR in Oman. Data analysis conducted in this study using percentage analysis to measure levels of satisfaction concluded that the users were satisfied with the EMR and are confident that the implementation of this system can improve the quality of patient care. A study in the United States (Kochevar et al, 2011) [21] also lead to the conclusion that the acceptance of an EMR system reaches seventy-five percent (75%) of the user selected sample, and more than fifty percent (50%) non-users expressed a positive response after being given the experience of using the EMR.

In addition to research on user satisfaction, some people also try to create a research model for the acceptance of EMR, one of them was by Haslina mohd and Sharifah Mastura syed mohammad in 2005. [1] The model they develop was based on two determinants of Technology Acceptance Model (TAM) which is ease of use and usefulness to predict acceptance of the system. It is said that the acceptance of information systems can be seen from the perceived ease of use and perceived usefulness of information systems in support of the work (Davis, 1989).[19]. But over time the model was criticized because it is said that TAM have less power to predict user acceptance (Lee, Kozar, & Larsen, 2003) [18].

Other factors that are considered influential in the development are user interface that covers the display screen, ease of learning , and the capability of the system, in addition to the user behavioral information quality (accuracy, completeness, up to date, sufficient, understandable, security, standardized, timely, and format of layout).

In addition to TAM approach, other researchers also developed a more comprehensive model, such as Hennington and Janz (2007) [13] who developed a model on the adoption of EMR using UTAUT

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model. UTAUT model was basically developed to measure the level of acceptance of information systems and stand for *Unified Theory of Acceptance and Use of Technology* (Venkatesh et. al., 2003). [14]. UTAUT indicates that behavioral intention and behavior to use a technology is influenced by performance expectancy, effort expectancy, social influence, and the conditions that helped *(facilitating condition*) moderated by sex *(gender)*, age, experience and volunteerism.

The success of a system depends on all the acceptance and use by individuals, from which satisfaction can be measured, and its direct impact on increasing the productivity of an organization. Measurement of user satisfaction is recognized as a key metric of success of information systems implementation (DeLone and McLean, 1992). [7], It is also believed to provide important implications for company (Brown et al., 2008). [1 1].

Performance Expectancy (PE) is defined as the degree of trust individuals put on the extent of use of the system that will help them to gain performance advantages in the job. Performance expectancy is formed of several constructs perceived usefulness of TAM obtained from the model that is understood as a person's level of confidence that using the system can improve their job performance (Venkatesh et al., p.448). [14]. Extrinsic motivation that comes from signal motivation model (Davis et al., 1993) [15], which is understood as a perception of where the user would use the system because of the perceived value of the achievement of performance such as performance, salary or pay, and promotion (Venkatesh et al., p.448). [14]. *Job fit* which is adopted from the model of PC utilization, is defined as how much the system's ability to improve individual performance (Venkatesh et al., p.448).[14]. *Relative advantage* adopted from innovation diffusion theory (IDT) is defined as the perceived degree to which innovation is better than its predecessor (Venkatesh et al., p.448). [14], and the latter is the *expectation* that adoption of the *Outcome* of cognitive social theory (Compeau and Higgins 1995; Compeau et al. 1999). [6]

Effort Expectancy (EE) is related to the ease of use of the system. Perceived ease viewed from several aspects such as clarity, easy to understand *(understandability)*, flexibility, and ease of use. Measurement of the level of ease is also influenced by several factors, such as sex *(gender)*, age, and experience (vankatesh, 2003). [14]. Construction of which is built from some of the *perceived ease of use* of TAM (Davis, 1989; Davis et al., 1989), [15] is understood as the degree to which a person believes that using the new system will be free of effort (Venkatesh et al., p. 451). [14]. *Complexcity* (Thompson et al., 1991) is the extent to which an innovation is considered difficult to understand and use (Venkatesh et al., p. 451). While *Ease of use*, is the degree to which innovation is considered difficult to use (Venkatesh et al., p. 451). [14].

3. THE METHODOLOGY

The research was conducted using primary data obtained by distributing questionnaires to the respondents who are EMR system users. Respondents in this study were drawn from a hospital that has been implementing a comprehensive EMR system with 188 respondents composed of nurses and general practitioners. Nurse respondents drawn from several service units such as ICU, ER, clinic, hemodialysis, obstetrics, perinatologi, and the operating room.

The questionnaire used consists of 37 questions and the demographic data form. Any answer to the question using Likert scale, ranges from very dissatisfied with score of 1, not satisfied with score 2, neutral with score of 3, and strongly satisfied with score of 5.

With reference to previous research and models based on the factors deemed to affect the level of user satisfaction EMR, then in this study identified five independent variables that will be investigated namely *performance expectancy* (PE), *effort expectancy* (EE), *information quality* (IQ), *facilitating condition* (FC) and the *organization culture* (OC). These variables were hypothesized to have impact on *user satisfaction* (S) as dependent variable. Since all variables are concept or latent variables, operation variables or indicators were devised for each of them in the form of statements or questions measured using Likerts scale as was mentioned earlier. Six operational variables were devised for latent variable PE, seven for EE, four for FC, seven for IQ, four for OC, and seven for dependent latent variable S, all were based on the previous studies. The relationship of these variables is depicted in Figure 1.

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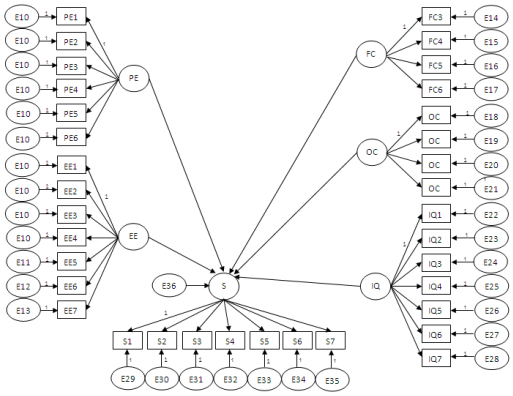

Figure 1. The Model

The hypothesis in this study are as follows:

Hypothesis 1 (H1): *Performance Expectancy* has a positive impact on the level of *user satisfaction* on EMR.

Hypothesis 2 (H2): *Effort Expectancy* has a positive impact on the level of *user satisfaction* on EMR.

Hypothesis 3 (H3): *Information Quality* has a positive influence on the level of *user satisfaction* on EMR.

Hypothesis 4 (H4): The condition of facilities has a positive influence on the level of *user satisfaction* on EMR.

Hypothesis 5 (H5): The *sharing of knowledge* has a positive influence on the level of *user satisfaction* on EMR.

Data were analyzed using Structural Equations Modeling (SEM) with Maximum Likelihood Estimation (MLE) in order to test the above hypotheses. Basically SEM modeling is done in two steps, i.e., first, since all variables are latent variables, it is necessary to ensure the validity and reliability of the operational variables or the measures and to determine the weight or contribution of each indicator to the latent variable it represent (factor loading) using *confirmatory factor analysis* (CFA). The following is the description of the model for latent variable "Performance Expectancy (PE)" (see Figure 1). Other latent variables was formulated in the same manner:

$$PE_1 = \lambda_1 PE + e_1$$
$$PE_2 = \lambda_2 PE + e_2$$
$$PE_3 = \lambda_3 PE + e_3$$
$$PE_4 = \lambda_4 PE + e_4$$
$$PE_5 = \lambda_5 PE + e_5$$
$$PE_6 = \lambda_6 PE + e_6$$

Where,

PE_1, PE_2 ,PE_3 , PE_4, PE_5,PE_6 = Information quality Indicators

λ_1 , λ_2 , λ_3 , λ_4 , λ_5 , λ_6 = *Factor Loadings*

e_1 , e_2 ,e_3 , e_4 , e_5 ,e_6 = *error terms*

The second step is the actual testing of the hypotheses using *multiple regression analysis*. From the relationship between dependent and independent latent variables, multiple regression analysis, the second step under SEM, was used with the following model:

$$S = \beta_1 PE + \beta_2 EE + \beta_3 FC + \beta_4 IQ + \beta_5 OC + e$$

Where,

S = User Satisfaction
PE = Performance Expectancy
EE = Effort Expectancy
FC = Facilitating Condition
IQ = Information Quality
OC = Organization Culture
e = Disturbance Error
β_1 , ... , β_5 = regression parameters

Data processing is done using SPSS-AMOS software.

4. RESULTS

After the deployment of the questioner, 188 respondents returned the data with the following descriptive statistics. 79 % of the respondents are female. The age ranging from 22 and above, where mostly (74%) are betwen 25 to 40 years old with period of work above 2 years.

From the data obtained, first the validity and reliability of every question or indicator posed to respondents were tested. Corrected Item-Total Correlation (or R-alpha) was used to determine the validity of the indicators by comparing against r = 0.1432 (obtained from the Table where N = 188,

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with df = N-2 = 186 with 5% significant level). To test reliability *Cronbach's alpha* coefficient was used. In general, for Exploratory Factor Analysis, it is required that *Cronbach's alpha* is greater than 0.6, while for Confirmatory Factor Analysis *Cronbach's alpha* is required to be greater than 0.7. The following table (Table 1) provides results of validity and reliability test for all variables:

From Table 1, it can be seen that *Corrected-Item Total Correlations* are greater than 0.1432 indicating that all indicators are valid measures of the respective corresponding latent variable. Similarly, the Table also shows that in general all indicators are reliable measure of the respective latent variables since most of them are greater than 0.7. Some indicators such as FC4, FC5 and FC6 however seems to have coefficient of *Cronbach's alpha* <0.7. However, since they are all greater than 0.6, they can be considered as reliable.

Table 1. Validity And Reliability Test Results

	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
PE1	0.748	0.860
PE2	0.768	0.857
PE3	0.783	0.855
PE4	0.708	0.867
PE5	0.703	0.867
PE6	0.507	0.895
EE1	0.636	0.855
EE2	0.644	0.855
EE3	0.751	0.841
EE4	0.656	0.852
EE5	0.588	0.864
EE6	0.692	0.847
EE7	0.609	0.859
FC1	0.323	0.756
FC2	0.383	0.734
FC3	0.507	0.704
FC4	0.587	0.677
FC5	0.600	0.677
FC6	0.539	0.696
IQ1	0.591	0.852
IQ2	0.606	0.851
IQ3	0.719	0.835
IQ4	0.809	0.822
IQ5	0.577	0.865
IQ6	0.627	0.847
IQ7	0.638	0.845
OC1	0.621	0.824
OC2	0.733	0.778
OC3	0.730	0.783
OC4	0.660	0.807
S1	0.806	0.915
S2	0.619	0.940
S3	0.830	0.912
S4	0.725	0.922
S5	0.854	0.911
S6	0.858	0.909
S7	0.827	0.912

In addition, there are two questions under *facilitating condition* (i.e., FC1 and FC2) had factor loading values below 0.4, each worth 0.34 to 0.39 for FC1 and FC2. Thus both these indicators were removed from the model.

Regression analysis was performed to see if from some of the variables tested had positive influence on the level of user satisfaction of EMR. The results were given in Table 2 as follows:

Table 2. Regression Analysis Results

	Estimate	SE	P
S <- PE	0246	0037	***
S <- EE	0098	0046	0034 **
S <- FC	0066	0038	0087 *
S <- IQ	0497	0078	***
S <- OC	0:16	0051	0002 ***

* P < 0.10; ** P <0.05; *** P <0.01;
DependentVariable = S

From the table above can be seen that the level of significance p *value* of PE is under significance value is p *value* <0.01 (1%), then the significance level of p *value* of EE is below the limit value is the significance of p <0.05, significance level of p *value* of IQ below the limit value of the significance p value <0.01 , Significance level of p *value* of FC is below the limit value of the significance p value <0:10, and the significance

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level of p *value* of OC was below the limit value of the significance p value <0.01.

In other words, the five hypotheses that have been defined at the beginning received. These five factors namely *performance expectancy*, *effort expectancy*, *quality information*, *facilitating condition*, and *organization culture* has a positive influence on the level of user satisfaction EMR system.

Of data processing is also found that 80% of respondents expressed satisfaction of the EMR system, it is similar to the results of research conducted in Oman (Al-Farsi et al., 2005) [1] and American (Kochevar et al, 2011) . In life there are no differences in levels of satisfaction among users who are relatively young with older users.

Table 3. Satisfaction Levels With Age Categories

Age category	STS	TS	N	S	SS	Satisfy (%)
20-24 Years	0	0	7	28	2	81.08
25-29 Years	0	0	20	55	11	76.74
30-34 Years	0	0	5	26	6	86.49
35-39 Years	0	0	3	14	0	82.35
> = 40 Years	0	0	2	6	3	81.82

If in an earlier study conducted by by Boonstra & Broekhuis (2010) [23] states that one of the obstacles in the implementation of EMR Sitem is the lack of participation and support from more senior doctors who are more comfortable using paper to keep medical records. It is certainly different from the results obtained in this study which states that the level of user satisfaction EMR on respondents aged over 40 years is quite high at 81%. This could be influenced by the *organization culture* is applied to the XYZ hospital. Given the average of the ratings *organization culture* is quite high at 79%. With this understanding of *knowledge sharing* can be ascertained senior employees will be more open to new things such as EMR system.

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