

Theoretical Model of Determinants Factors of Health Information Technology (HIT) Acceptance

Nina Sevani

Department of Informatics Engineering
Krida Wacana Christian University (Ukrida)
Jakarta, Indonesia
nina.sevani@ukrida.ac.id

Budi Marpaung

Department of Industrial Engineering
Krida Wacana Christian University (Ukrida)
Jakarta, Indonesia
budi.marpaung@ukrida.ac.id

Abstract— Knowledge of determinants factors of Health Information Technology (HIT) acceptance is important for successful implementation of the technology. So far, the Technology Acceptance Model (TAM) and Unified Theory of Acceptance and Use of Technology (UTAUT) are commonly adopted to measure user acceptance of the technology in the medical field. However, to be implemented in developing countries, those models should be extended. One of the determinant factors that affect user acceptance of the HIT in developing countries is cost-effectiveness. Therefore, in this study, we develop a theoretical model by elaborating variables from TAM and UTAUT with cost-effectiveness. The proposed model is expected to give benefit to the healthcare provider in developing countries, to implement a proper strategy of the HIT.

Keywords— *cost-effectiveness; medical area; TAM; user acceptance; UTAUT*

I. INTRODUCTION

Utilization of information technology and communication (ICT) in the medical field is rapidly growing. Cost efficiency and capability to improve working conditions are some of ICT's benefits that can lead to the improvement of service quality in medical field [1,2,3]. However, the implementation of ICT requires proper strategy to ensure that the proposed technology is accepted by its users and fits with the environment where technology is implemented. Therefore, it is important to find out determinant factors that influence the successful implementation of technology. Previous studies suggest that factors such as organization's characteristics, user's characteristics, and socio politic's characteristic of the environment around the implementation might affect significantly to the successful implementation of technology [4]. In regards with user's and socio politic's characteristics, some factors should be considered before any implementation of new technology, such as age, profession, computer usage at home or in the workplace, and user's general perspectives of technology [3].

Knowledge about determinant factors of technology's acceptance is very important due to successful implementation of new technology often contrasted with low level of success [6]. Several models are widely accepted to measure user acceptance of technology and to measure determinant factors of the user acceptance, such as: Technology Acceptance Model

(TAM), Unified Theory of Acceptance and Use of Technology (UTAUT), Diffusion of Innovation (DOI), and Fit between Individuals, Task, and Technology (FITT) [7,8,9,10,11,12,13,14].

Some research was also conducted to uncover supporting and barrier factors in the implementation process of new technology in medical fields. Measurements had been formulated from nurse's side, physician, and health care provider [1,13,14,15], however, there are gaps need to be explored to understand the supporting and barrier factors of the successful implementation of new technology from patient's or public side, remembering that successful implementation of new technology in medical fields basically need cooperation from three actors, that are doctor or physician, hospital management, and patient [16].

Previous research revealed that organization support, environment, and user's attitude of technology are several crucial factors to determine the level of acceptance of technology used. In other words, if users have a less favorable perception of certain technology, concurrent with lack of organization's support, it is mostly believed that the proposed technology will not be accepted. User's perspective also involves user's willingness to study new technology, user's awareness of technology's benefit, and user's capability to use technology (i.e. experience, skill, knowledge). Reference [3] revealed that socio-demographic factors (age, gender, profession) also influence the acceptance of the technology, coexisting with personal perspectives of the technology itself.

Indonesia, as one of developing country, naturally has a different environment with most of the developed countries, in terms of adoption and acceptance of the technology. This happens because the Indonesian people have a different stage of willingness and awareness of technology, availability of infrastructure, compared with people from the developed country. According to the situation, this paper aims is to propose a model to predict the determinant factors that may influence the acceptance of technology in a medical field. The result of this research can be used as an input for hospital's management to know the characteristics of the user and the organization in detail. Knowledge of this characteristics can be a guideline for hospital's management to formulate the right strategy for implementing technology in a medical field, in order to support the improvement of medical services.

II. LITERATURE REVIEW

A. Health Information Technology (HIT)

HIT or often referred to as Health Information System (HIS) or health informatics arise due to the rapid development of technology in a medical area [17]. There are many forms of new medical system which is the utilization of HIT, like Electronic Medical Record, Personal Health Record, Clinical Decision Support System, and medical information system [17,18]. Besides the emergence of many new forms and services in a medical area, the implementation of HIT can also improve the distribution of medical services to the community.

HIT's utilization can provide optimum contribution if there is acceptance by its users, from nurse's side, physician's side, hospital staff's side, and also patient's side. Generally, HIT's acceptance can be influenced by internal factors like HIT's characteristics and external factors like user's characteristics [4,19]. Autonomy, self-control, competence, effectivity and sufficiency, relatedness or association are some of the internal and external motivation that can be influence user acceptance of technology in form of HIT [19].

B. Technology Acceptance Model (TAM)

The importance of user acceptance of technology motivates researcher to develop many models to measure user acceptance level of technology. One of the popular model used to measure user acceptance of technology in medical area is TAM [6]. TAM was motivated by some theory of perception and factors contributed to technology acceptance. The idea about TAM was introduced by Davis in 1986 as an adaptation from Theory of Reasoned Action (TRA). In the beginning, TAM consists of two belief factors, that are Perceived Usefulness (PU) and Perceived Ease of Use (PEU), that influence technology acceptance, as shown in Figure 1 [20].

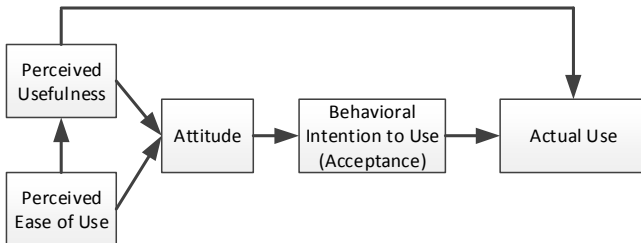


Figure 1. Initial Model of TAM

TAM explain causality between system design, PU, PEU, and attitude toward user's intention and behavior to use technology. TAM utilization explains the reason for user's acceptance and rejection of technology, so for the next, it can be do some improvement to upgrade user's acceptance level.

In a medical area, TAM is popular due to its ability to measure the acceptance of technology at the individual level. Beside that, TAM also focused on the measurement of individual's intention of technology [6]. Nevertheless, there is some drawback due to limitations in the number of independent variables used in TAM. TAM only emphasize individual level, giving less attention in external aspects, such

as socio-political aspect and organizational aspect, where technology will be implemented [6].

C. Unified Theory of Acceptance and Use of Technology (UTAUT)

UTAUT is developed based on TAM, with some improvement to fix drawback of TAM. Similar to TAM, UTAUT also measures the acceptance level of technology at the individual level and focus on behavioral intention [6].

Basically, UTAUT is a combination from eight popular model to measure acceptance level of technology, that are Theory of Reasoned Action (TRA), Theory of Planned Behavior (TPB), Technology Acceptance Model (TAM), combination of TPB and TAM, Motivational Model, Personal Computer (PC) Utilization, Diffusion of Innovation (DOI), and The Social Cognitive Theory. UTAUT contain social and organization variable to measure user's acceptance level of technology as shown in Figure 2.

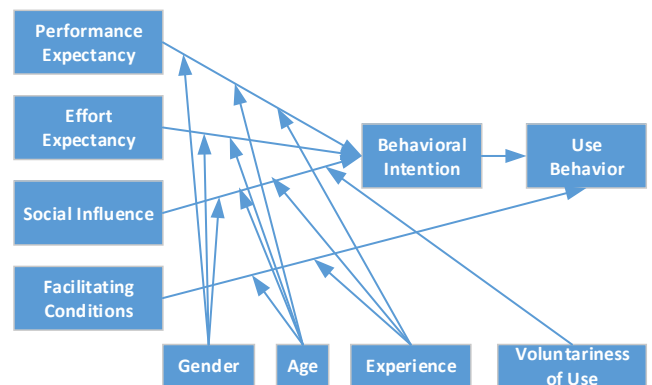


Figure 2. UTAUT Model

UTAUT also popular to measure acceptance level of technology in a medical area. The popularity of UTAUT is caused by its comprehensiveness [6] because this model also involves organization and social factors [21] and remain to emphasize in contextual factors [22].

D. Determinant Factors of HIT's acceptance

There are some important facts to support successful implementation of new technology in medical area, such as the technical ability of the application, ease of use of the application, innovation, and relevance between application's content with the condition [13]. There are also some important keys to use HIT, like the adequacy of technological resources, availability of internet access, the popularity of technology in the user environment, and personal motivation from user [1,13,15,19]. Personal motivation factor including self-control in using technology, knowledge, and skill to use technology, and support from co-workers, while the adequacy of technological resources and popularity of technology in user environment are the factors related with the organization and socio-politics where HIT implemented.

In contrast, personal motivation and environment also can be obstacles in implementation process of new technology [1,10,13,14,15,19]. Lack of computer, internet access, and any

form of technology in working environment, the absence of staff's training on how to use technology, and "not accustomed" to using technology in daily work, are some of condition that can be obstruct user's acceptance of new technology, while personal motivation is more toward resistance to change [9,15]. Resistance to change occurs because of the lack of confidence to use technology, lack of ability to use technology, lack of awareness of the benefits of technology, and lack of desire to learn new technology [1,3,19,23].

III. THEORETICAL MODEL

The theoretical model is adapted from TAM and UTAUT with adding cost-effectiveness variable [17]. Cost-effectiveness variable is needed because cost becomes one of determinant factor in successful implementation of technology [1]. Cost is important and can influence user perception of technology and system, especially in developing country [17].

In this theoretical model, social influence and facilitating condition variables, written down as readiness, that consist of two sub-variable (organizational readiness and technical readiness). Figure 3 shows the theoretical model with the relationships between variables.

The basic difference in the theoretical model compared with TAM and UTAUT is in the cost-effectiveness variable, which is expected to make this model suitable to be applied in Indonesia. As a developing country, the cost still becomes one of the determinant factors in successful acceptance of technology in a medical area. This model will focus in individual behavior to find out the personal factor that can influence user acceptance of the technology.

This paper also provides the detailed explanation about the cost-effectiveness variable, including the description of each sub-variables inside, which is not explained in the previous research [17]. Beside provide the detailed description of cost-effectiveness variable, this paper also takes validity and reliability testing on the variable. The testing using respondent from one private hospital in West Java. The testing result can be used to predict the possibility of conformity of the theoretical model in Indonesia.

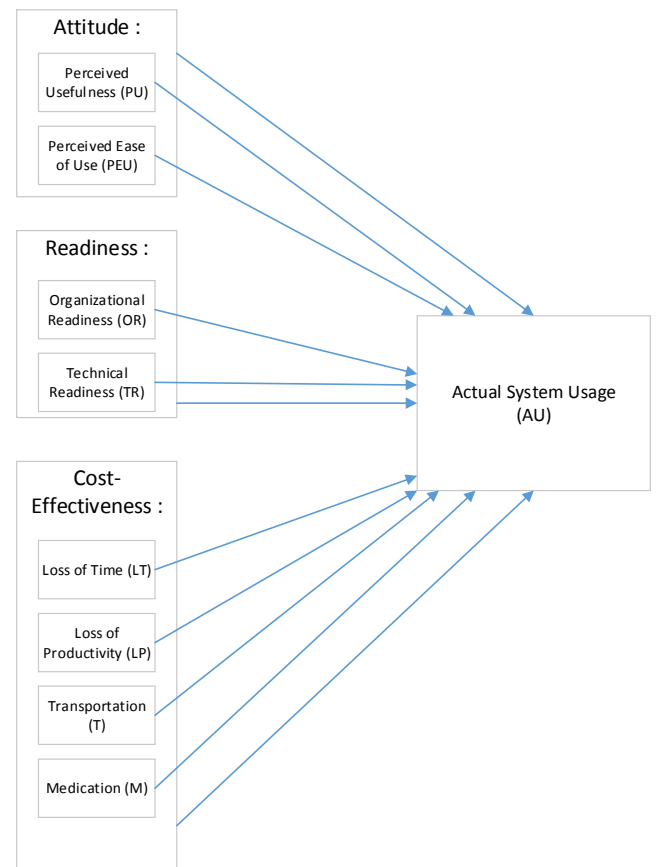


Figure 3. Theoretical model

A. Variabel dan Sub-Variabel Gauges

Table 1 describes variable and sub-variable gauges employed in this theoretical model.

TABLE 1
DESCRIPTION OF VARIABEL AND SUB-VARIABEL

Sub-Variable	Description	Author, Year
Perceived Usefulness (PU)	Performance expectancy, how new technology can work and help a user in work.	20,21,25,26
Perceived Ease of Use (PEU)	Effort expectancy, which is how difficult to learn new technologies being implemented	20,21,25,26
Organizational Readiness (OR)	Organization support, such as resources availability, infrastructure availability, and management support.	1,13,14,15
Technical Readiness (TR)	Experience to use technology and internet, including self-confidence to use a computer and new technology.	1,3,10,12,13,14,23
Loss of Productivity (LP)	Productivity enhancement due to information support and integration with others units.	27,28
Medication (M)	The use of technology can help patients to feel the treatment effect,	29

	and be convincing that the treatment procedure is done right.	
Transportation (T)	Technology provides information needed quickly, accurate, consistent, and easy to get.	30
Loss of Time (LT)	Technology allows time to finish the job quickly and reduce patient's queue time to get medical services.	31

B. Items Question

Sub-variables described in Table 1 are translated into several questions. This questions will be answered by respondents or HIT's users, like nurse and hospital's staff that used HIT in their daily work in order to serve patients.

There are 45 questions for all sub-variable mentioned in Table 1. For sub-variable PU, there are seven indicators, sub-variable PEU has five indicators. Variable readiness, that consists of sub-variable OR, has seven indicators, while sub-variable TR employs six indicators. Cost-effectiveness variable which consists of four sub-variable (LP, LT, M, and T), has 20 indicators in total. For sub-variable M and T, each has five indicators. While sub-variable LP described by seven indicators and sub-variable LT explained by three indicators.

While for Actual Usage (AU) as the measured variable, there are three indicator. Total before the validity and reliability testing, there are 48 questions of the theoretical model.

C. Validity and Reliability Testing of The Model

The validity and reliability testing was conduct using SPSS. The aim of the validity testing is to measure the accuracy of the variables gauges to the measured variable. While the reliability is to assess if the testing result of all the variables in the theoretical model shown the consistant result. Tabel 2 describe the summary of the validity dan reliability testing.

TABLE 2
THE RESULT OF THE VALIDITY AND RELIABILITY TESTING

Sub-Variable	Validity	Reliability
PU	Valid	Reliable
PEU	Valid	Reliable
OR	Valid	Reliable
TR	Valid	Reliable
LP	Valid	Reliable
LT	Valid	Point 1 & 2 : Reliable; Point 3 : Not Reliable
T	Valid	Reliable
M	Point 1-4 : Invalid; Point 5 : Valid	Reliable
AU	Valid	Point 1-3 : Not Reliable; Point 3 : Reliable

Based on the result of validity and reliability testing, there are some reduction of the number items questions. The item questions that are not valid or not reliable not be used to measure the model. Total there are only 41 questions for the model.

I. CONCLUSION

The model proposed in this paper is developing from two popular model used to measure user acceptance of technology in a medical area. Uniqueness from this theoretical model lies in cost-effectiveness variable, due to cost is one of the determinant factor of technology acceptance in developing country, including Indonesia. Further, the model proposes that social influence variable from UTAUT could be elaborated into readiness variable which consists of two more sub-variables: technical readiness, which concerns with readiness and user personal experience of technology, and organizational readiness, which concern with social and organizational support where technology is implemented.

The model suggests that the measurement of acceptance of technology should be conducted at the individual level. This model is expected to give input to the healthcare provider in developing country, especially in Indonesia, to know supporting and barrier factors in the implementation process of technology in a medical area. Regarding these determinants factors, the implementation process of HIT can run smoothly and the existence of HIT is acceptable to its users.

The theoretical model is still limited to individual behavior, so the conclusion only describes individual behavior at the organization level. Lack of empirical fact also another limitation of the theoretical model, which makes the conclusion cannot be specific according to the data used. Future research is expected to expand this model for organization level behavior, accompanied by empirical data from many related organizations.

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