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An investigation of external factors for technological acceptance model of nurses in Indonesia

D B Setyohadi[1] and N W Purnawati[1]
Magister Teknik Informatika, Universitas Atma Jaya Yogyakarta, Yogyakarta,
Jl. Babarsari 44 Yogyakarta, Indonesia 55281.

Abstract. The Indonesian government policy has required the hospitals in Indonesia to implement a health information system. There are still found many barriers in its implementation in the hospitals such as lack of facilities and human resources which lead to the problem complexity. As a result, the e-health system implementation has not been being optimum. This study is purposed to recognize the problem of technology implementation, particularly the adoption of the aplication system by using Technology Acceptance Model (TAM) theory. By reviewing the previous studies and literatures, we detected the need to relate the external variables of PEOU and PEU which are rooted in TAM. The study we conducted shows that TAM model application as the e-Health measurement framework in Indonesia needs to be extended particularly its factors which significantly influence PEOU and PEU. The factors are personal factor and organizational factor. Furthermore, a model is formulated for future empirical testing.

1. Introduction
Hospital information systems become a technology that was instrumental in the development of hospital in Indonesia. It is required since demographic have raised attention regarding the need to escalate the level of life and health. Although e-health is important there are many problems cased form external factor around e-health such as infrastructure, human resource. Therefore only a few of e-Health implementation is successful since the number of user acceptance of e-Heath also rise slowly. To solve that condition, the proper model for analysis of acceptance e-Health is needed.

In 2009 the ministry of health of Indonesia made regulations in article 52 paragraph 1 Number 4/2009 regarding record keeping and reporting of all activities in hospitals to the Ministry of health, it was conducted in a system that is a hospital information system (HIS). It is done to find out the performance on both government and private hospitals. This condition represents that e-Health services are viewed as the best alternative solution of the health quality improvement problem management. Furthermore, it possibly covers both healthcare services and innovation [1] Many countries have created policy with regard improvement of service in health by developing of e-health [2] in order to make ease the process of operations on community service [3][4][5]. Furthermore, a study of e-Health implementation problem in the developing country is also limited. The critical factor should be studied in advanced since the developing countries require a bigger requirement for a better e-Health implementation [6]. It is needed since the demand of health care is increased and service alternatives and health personnel are still becoming scarce. In Indonesia, not all Hospital can be maximized using HIS. This can be seen by the differences between the intention of both private and public hospital management [7]. In Indonesia, the acceptance of HIS is greatly influenced by Human Characteristic, Technology and Organizational [8].

The lack of infrastructure and resources has become the contributory causes the problem of e-Health implementation. In some hospital, many nurses still do the manual hospital report, therefore,

the nurses need a sense and knowledge to understand the associated system and the desire to use the system. In short, the use of e-health in developing country is important, and it needs a big effort. This conditons is the reason why the research should be performed. Furthermore, Technology Acceptance Model (TAM) is used since TAM is the frequently used model to assess the acceptance of users to adopt the new technology [9]. TAM has two main concepts. They are usefulness and ease of use perception. This study will be focused to investigate the acceptance factors of the nurses in Indonesia when they adopt e-health. World Health Organization reported that there are some problems or barriers in terms of e-health implementation in hospitals. Some barrier of technology adoption, such as lack of experiences using Informatics Communication Technology (ICT), lack of training, the support of organizations such as the infrastructure problems must be fixed [8]. It is becoming an important issue for management of hospitals in the region of Indonesia. This research will explore the methods with a development approach on problem of TAM that influences the nurse perception of acceptance of adopting e-health. Furthermore, the appropriate model will be developed, and the framework skeleton of acceptance of adopting e-health is proposed. It can hopefully help the hospitals to find the significant factors that influence the acceptance of nurses in e-health in Indonesia.

2. Literature Review

Technology acceptance Model (TAM) was developed as an extension of the Theory of Reaction Action (TRA) [9]. TAM is useful to describe the relationship between attitude and behaviour of human volitional. This relates to a person's motivation to show the reaction based on the intention [10]. TRA aims to predict the intentions of behaviour, including the motives underlying the formation of the behaviour. Using that theory, Davis tries to formulate the relationship with the behaviour of acceptance. Moreover, TAM is focused on the acceptance of users based on 3 factors i.e. ease of perception, perception and attitude toward the use of utilization systems especially on the perception ease of use (PEOU) and Perception of Usefulness (PU). In addition, it is recommended that if the system was already considered to be useful then users will develop the use of these intentions become stronger. With regard to external factor, UTAUT is developed by removing the attitudes for being minor roles against external variables that allows the influence. Furthermore, subjective norm, image, Job Relevance, the Output Quality, and the result of external as demonstrability are connected by a sense of usefulness associated based on voluntary user experience and technology [11].

Based on their stakeholder's point of view, the e-health implementations have many dimensions, consequently it has a more complicated and complex requirement [4]. Due to its complexity, many studies about TAM, with regard to e-Health Care, are performed not only by applying but also extending the required variable. For example, Ahlan, and Ahmad [12], used Output Quality on the original model of TAM and added a factor of Perceived Cost-Effectiveness which can then affect the attitudes towards the use of technology. The same is also done by Kuo, Liu, & Ma [13], which combines the factors of technology readiness index (TRI), 5 these factors such as Optimism, Innovativeness, Insecurity, and the Discomfort became the influence on the two important factors of TAM i.e. PEOU and PU.

In perspective of user, regarding barrier problem of e-health, cultural approach is an important factor which should be considered when e-health is designed [14]. The suitable e-health design was able to figure out the intentions of the user (Intention to Use). Gajanayake, Iannella, NICTA, & Sahama [15], used 3-dimensional technology reporting to individual context, technology and implementation context on the Unified Theory of Acceptance and Use of Technology (UTAUT) which is developed by Venkatesh, Morris, Davis, & Davis [11]. On the other case, Srur & Drew combined factors of several models such as TAM, TAM 2, Diffusion and Innovation (DOI) and the UTAUT to understand the success and influence of the personally controlled Electronic Health Records (PCEHRs) [16].

TAM is also used by Bezboruah, Paulson, & Smith to understand the attitude of the staff and procedures at the care home against use of Hospital Information Technology (HIT) [17]. Holden & Karsh study that the increasing study of the acceptance of e-Health is accompanied by changes and integration of e-Health based on patterns, rules or the concept of the use of e-health [18].

With regard to design, many studies reported that technology is an important factor particularly as the e-health ability to match the local condition [19]. The latest technologies capability made e-health to adapt the changing of the environment in order to make a greater acceptance of the user [20]. Rely on these phenomena; it is in-line that PEOU is the easier design. It could be understood since PEOU will face to the adaptability problem directly [21]. To raise the acceptance, e-Health aplication must be able to provide an interface which supports exchange information [22].

Many studies have been performed to improve the acceptance of e-health. It should be noted that in the implementation of application, the design of interface is focused only to deal with social cultural problem [23, 24]. The previous study related to the acceptance matters reveals that the design aspect is the solution part of social aspect management. Therefore, the most fundamental aspect to explore is the social aspect which should be linked to PEOU. The previous survey research exposed that external factors mainly such as personal and organizational factors have relation with it.

3. Model Development

According to the previous explanation, this study is aimed to develop a model based on TAM ad its extension. Theoretically, institutions, particularly institutions which us e-health, have significant roles that are capable of dealing with the environmental pressure [7]. Many studies report that institution is able to influence its community to adopt a new system when they manage attitudes properly [25]. With regard to institution roles and individual characteristics, the PEOU and PEU of TAM are significantly influenced by organization and its people. Both of them, when combined with technological capability, could be considered as a comprehensive framework for measuring the quality of information system application [26][27][18]. Since the development of technology moves quickly, we believe that technological capability is a must. Furthermore, the factors, which should be considered are two i.e. organization and personal factor. They influence directly to both PEOU and PEU of TAM and it is categorized as an external factor and the detailed is described below:

3.1. Personal factors

Because e-health, particularly on nurses, is limited on the previous literature, it is important to address the question about attitude towards e-health by looking at the literature which related to both TAM e-health. To make it easier, the study is focused on the personal factor and its environment. Personal factors which is the most important in this case is IT knowledge /experience that it may also be affected due to lack of experience and knowledge about information technology [6]. Things that are closely related that can be influential as well are factors of age, gender, and skill, demography factor of staff [25][29]. In addition, another factor which can be influential in adopting e-Health among nurses is the interface usability. Scholtz, Mahmud, & Ramayah [30] understand that user interaction can be associated against acceptance of the adoption of a technology.

Related to PEU problem, in e-health is common when we relate to interface design of e-health [31]. In terms of e-health, interface usability can be a personal factor in maximizing the performance of e-health [23]. Another scholar reported that the efforts of management to optimize the interface design will significantly influence the usability and usefulness particularly when the e-health is implemented [32]. Regarding there is much hospital management in rural area in Indonesia, to summarize, the component should be considered as an important factor in personal factor can be categorised as follow:

- Presentation, e-Health is a design conceived by nurses and organizations.
- Navigation, ease of access is an e-Health that is easily understood by nurses and organizations.
- Learnability as an easier guide for nurses and organizations without having to use the introduction of the system.

3.2. Organizational factors

World Health Organization (WHO) reveals that the Indonesian government had a response to ICT education on a medical professional such as nurse, but the barriers to learn to use e-health is still high. The Organization has an important role in supporting the implementation of e-health in hospitals in

Indonesia. This can be observed on the WHO data regarding the lack response of the government against software, skills training, ongoing support, scholarship and ICT Equipment.

The role of organization in technological acceptance problem is must. Many aspects of user acceptance are build by a variety of organizational factors which could be a main determinant of it [33]. The influence of organizational relationship into positive beliefs about the new technology is proven, and it is performed when the information is well distributed [34].

In information system, the organization significantly influences technological acceptance. When user feels better support the performance is improved [23]. There are many supports regarding acceptance of e-health. As example, the management should provide sufficient guidance regarding lack of knowledge [35], technically support [36]. Regarding familiarity to the system, the management should involve user when system is developed and more over training is needed [23][37]. Training is an important component, and it is suggested to be done during, and after implementation [38].

Shortly, the relation both or Information system user motivation and an external variable are illustrated in Figure 1, and the summary of both two factors are described below:

- Personal factors consist of IT Knowledge/ Experience i.e. knowledge or experience nurses and organizations to find out what activities and information related to e-Health. Personal other factors, interface usability, i.e. are the interaction that must be understood by nurses and organizations regarding e-health.
- Organizational Factors comprising infrastructure, clinical data sharing, and training is a challenge from nurses and organizations to improve the e-Health.

For this purpose, we have proposed and delineated a model to investigate the relationships among user, management roles and attitude towards e-health. To summarize this paper, we focus on the fact that e-health is being used increasingly by hospital management due to regulation in Indonesia and it still has the nurse's acceptance problem. Thus, we recommend well-made studies to be conducted to examine the many relationships which provide valuable knowledge. Hopefully it can be used to design and implement e-health that promotes the benefit of stakeholders in hospital management.
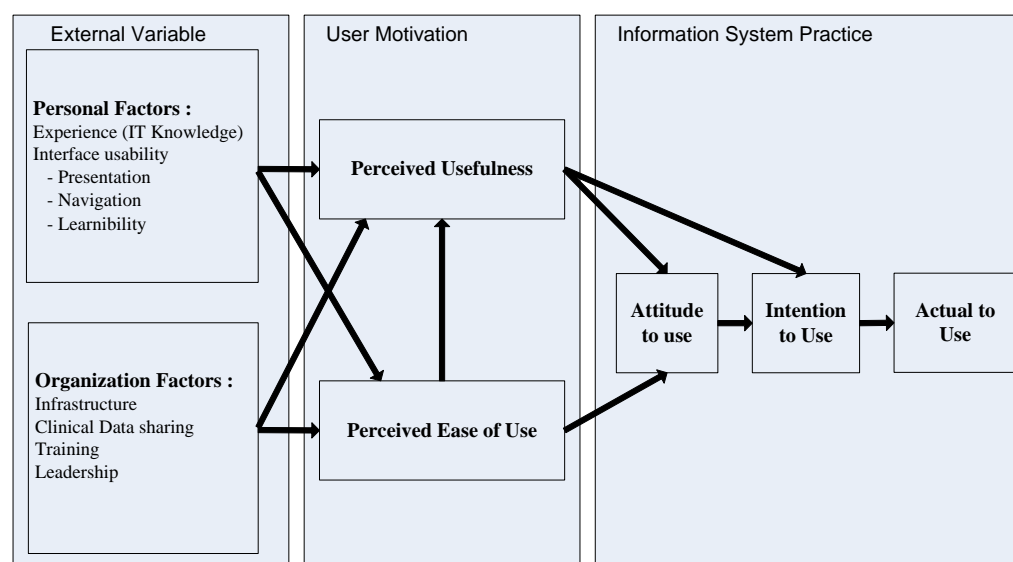

Figure 1. An Elaboration of External Factors for Nurse Adoption in e-health in Indonesia

4. Conclusion

We study an overview of e-health for nurses and TAM. This paper has proposed an external factor which will most significantly influence PEOU and PEU of nurses when they use e-health as an alternative approach analysing acceptance model of e-health by nurses. External variable focuses on personal and organizational factors, and then the motivation factor focuses on the concept of TAM that

is PU and PEOU as well as information system practice that focuses on attitude to use, behaviour intention to use and actual system to use e-health.

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