

Exploring Factors Influencing ‘Perceived Usefulness’ and Its Relationship on Hospital Information System End User Satisfaction

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Abstract: - The end user of Hospital Information System (HIS) holds a significant role in determining the success of the HIS implementation. Two critical factors that most influence end user are Perceived Usefulness and satisfaction. This paper investigates user’s ‘Perceived Usefulness’ and its relationship with the end user satisfaction factor in HIS environment. The investigation is carried out by reviewing various literatures with the main focus on the extended Technology Acceptance Model and the modified End User Computing Satisfaction Model. The relationship between Perceived Usefulness and end user satisfaction in HIS can be determine through the Information Success Model as proposed by Delone and Mclean (1992) which highlight on the factors of Information Quality, Service Quality and System Quality. It is a fair approach to apply these three factors in evaluating end user ‘Perceived Usefulness’ and end user satisfaction of HIS without fully rely on human’s subjective perception. Based on these three criteria, the appropriate questionnaires could be generated to evaluate users’ ‘Perceived Usefulness’ and end user satisfaction on the HIS.

Key-Words: - End User satisfaction, Hospital Information System, Perceived Usefulness, Technology Acceptance Model

1 Introduction

Information Technology (IT) has been introduced in the healthcare industry with the aim of supporting a wide range of highly specified health care task and services. Main component of the IT in healthcare industry is the Hospital Information System (HIS), defined as the socio-technical subsystems of a hospital, comprising all information processing systems as well as the associated human or technical actors in their respective information processing roles [1]. HIS is an integrated information system that have an important role in supporting various hospital affairs through the use of appropriate hospital information technology. Among the role of HIS in hospital is for patient administration, hospital financial affairs, and legal affairs [1]. The advantages of this computerised system include time saving, higher information accessibility and enable information sharing to facilitate communications among multiprofessionals [2].

Research done has shown that the healthcare professional hold a significant role in the adaption and evaluation of the HIS [1]. Physicians for instance are mainly involve in the system as they are

the ones who will be sharing patient health information system, integrating related data to provide healthcare professionals with necessary information, and promote cooperation and integrity in the treatment process [1]. Hence the user satisfaction criteria which can also lead to user acceptance can be deduced as one of the key component in achieving success for the implementation of HIS.

The Technology Acceptance Model (TAM) in Fig.1 was proposed by Davis (1989) has been widely adapted in many areas of research related to the technology acceptance by the end user. The TAM is a flexible tool for measuring user acceptance and for analyzing strategies that promote user acceptance [1]. It provides the theoretical base for explaining or predicting the factors that cause an individual to accept or reject IT [2] by proposing that people’s attitudes towards various behaviours and subjective criteria determine their behavioral intentions towards technology applications, which consequently affect their own behaviour [1].

Based on the TAM, the element ‘Perceived Usefulness’ and the ‘Perceived Ease of Use’ are the

major elements that affect IT acceptance and these elements are prone to be influenced by many external variables [1]. ‘Perceive Usefulness’ is defined as the user’s subjective beliefs regarding the benefits of using HIS to achieve job goals within a medical practice. As the user perceive the degree of system usefulness as sufficiently high, the user will tend to become more positive and willingly accepting towards the system. As they believe that

such system will benefits in terms of work performance, the users will also adopt a positive attitude toward the system [1]. Meanwhile, ‘Perceive Ease of Use’ can be defined as the degree to which users believe that using HIS would be free from effort. As the learning process of how to use the system are perceived easier by the user, the more positive is their attitude toward accepting the system [1].

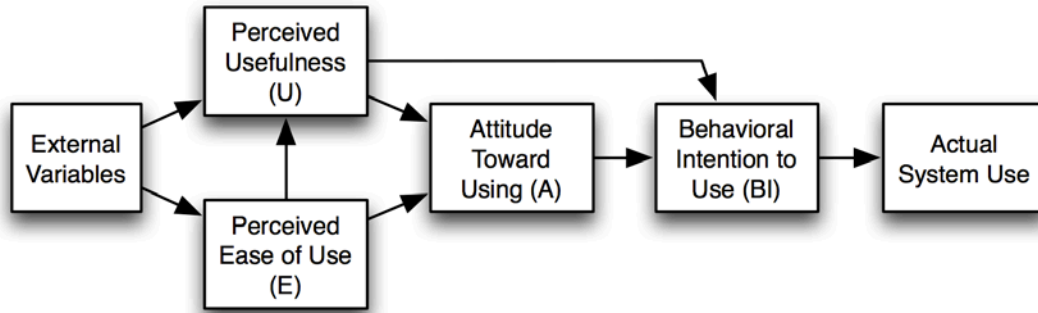


Fig. 1: Technology Acceptance Model [3]

The End User Computing Satisfaction (EUCS) can be described as the Information System end-user’s overall affective and cognitive evaluation of the pleasurable level of consumption-related fulfillment experienced with the Information System [4]. Measuring the EUCS has been an important tool and has a long history in the Information System (IS) context. However, the evolution of the IS technology calls for an updated mechanism to measure the EUCS especially in the healthcare industry where new technology medical equipments keeps emerging and the technology demand is moderately changing due to the changing lifestyle of human being.

The aim of this research is to investigate factors that influence end user’s ‘Perceived Usefulness’ and finding its relationship with the HIS ‘End User Satisfaction.’ The factor ‘Perceived Usefulness’ is of interest due to its higher significance as compared to the ‘Perceive Ease of Use’ in the TAM as highlighted by Davis. This is based on the justification that if the computerised system is believed to be useful and can enhance the job performance, users will be more willing to cope with the difficulties of use after weighing the benefits and efforts of using it [2]. This study will be based upon the existing past models used by various researchers and done by reviewing various journal papers. The factors relating ‘Perceived Usefulness’ with ‘End User Satisfaction’ will be identified and subsequently a structured questionnaires will be proposed based on the factors.

2 Methods

The methodology of this study is by reviewing and extracting information from various journal articles in this related field. Main focus of reviewing are given on the widely adapted TAM and the EUCS model which are also often extended or modified by the researchers to match with their related area of interest.

Various extensions have been made to the TAM in studying the acceptance of user on the implementation on the HIS. This is mainly because TAM is not a model developed specifically in or for the health care context. If used in its generic form, TAM may not capture or indeed may contradict some of the unique contextual features of computerized health care delivery [5]. Among the modifications made to the TAM in the study of user acceptance in the healthcare industry include proposing the external variables that influence the ‘Perceived Usefulness Factor’ such as the extended TAM based on the HOT-Fit Framework (Fig. 2) as proposed by Chen & Hsiao (2012). This extended TAM basically introduce the external variables which can be classified into three groups: personal (human) characteristics, organizational characteristics and information system (technology) characteristics

Various external variables which is believe to influence user’s ‘Perceived Usefulness’ criteria from a number of literatures are summarized in TABLE 1.

3 Modification of End-User Computing Satisfaction (EUCS) Model

Initial EUCS model was based on five independent constructs of content, format, accuracy, timeliness

and ease of use which are used to estimate the dependent variable. Similar to TAM, many enhanced model of the EUCS were later introduced to include additional constructs such as the Extensive EUCS model in Fig. 2 which introduced additional constructs of system speed, interface,

training and support in both in sourcing and out sourcing.

Various constructs which are added to the conventional EUCS model from a number of literatures are summarized in Table 1 below.

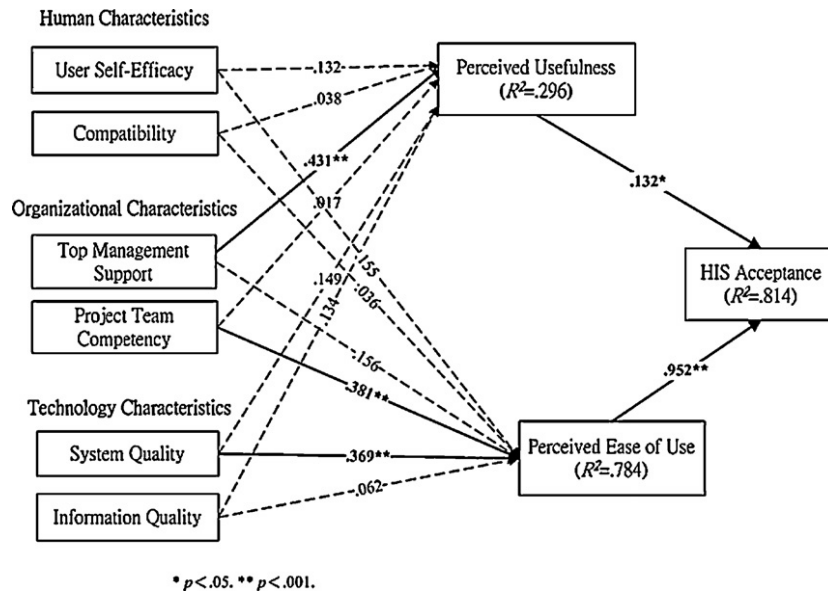


Fig. 2: Extended TAM Based on The HOT-fit Framework [1]

Table 1 External Variables Believe to Influence User's 'Perceived Usefulness' Criteria In The TAM

Author	Title	External Variables Believed to Influence User's 'Perceived Usefulness' Criteria in The TAM	End User Studied
Dixon (1999)	The behavioral side of information technology	1. Individuals' fit to technology a. Requirements b. Capabilities i. Available Resources ii. Sophistication 2. IT enabled innovations	-
Aggelidis & Chatzoglou (2009)	Using a modified technology acceptance model in hospitals	1. Social Influence 2. Facilitating Conditions (training)	Physician Nurse Administrative
Venkatesh & Davis (2010)	The technology acceptance model: its past and its future in health care	1. Subjective Norm (Social influence) 2. Image 3. Job Relevance 4. Output Quality 5. Results Demonstrability	-
Pai & Huang (2011)	Applying the Technology Acceptance Model to the introduction of healthcare information systems	1. Information Quality 2. Service Quality 3. System Quality	Nurse
Chow et al. (2012)	Nurses' perceptions and attitudes towards computerisation in a private hospital	1. Demographics 2. IT Support	Nurse
Chen & Hsiao (2012)	An investigation on physicians' acceptance of hospital information systems: A case study.	1. Human Characteristics a. User self-efficacy b. Compatibility 2. Organizational Characteristics a. Top Management Support b. Project Team Competency	Physicians

		3. Technology Characteristic <ol style="list-style-type: none"> a. System quality b. Information quality 	
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Table 2 Comparison of Additional constructs FOR THE Conventional EUCS Model

Author	Title	Additional Constructs for The Conventional EUCS Model Proposed by Various Literatures
Etezadi-Amoli & Farhoomand (1996)	A structural model of end user computing satisfaction and user performance	<ol style="list-style-type: none"> 1. Documentation 2. Ease of use 3. Functionality of system 4. Quality of output 5. Support 6. Security
Rivière, Lasalle, & Gousty (1999)	Hospital Information Systems Quality: A Customer Satisfaction Assessment Tool	<ol style="list-style-type: none"> 1. Information Quality <ol style="list-style-type: none"> a. Accuracy b. Completeness c. Up-to-date d. Sufficiency e. Understandable f. Security g. Standardized h. Timeliness 2. System Quality <ol style="list-style-type: none"> a. Interface b. Function c. Performance 3. Service Quality
Zviran (2003)	Measuring IS User Satisfaction: Review and Implications	<ol style="list-style-type: none"> 1. Perceived benefits <ol style="list-style-type: none"> a. User expectations b. Ease of use c. Perceived usefulness 2. Organizational Support <ol style="list-style-type: none"> a. User attitude toward IS b. Perceived attitude of top management 3. User Background <ol style="list-style-type: none"> a. User experience b. User skills c. User involvement in system development
Aggelidis & Chatzoglou (2012)	Hospital information systems: Measuring end user computing satisfaction (EUCS)	<ol style="list-style-type: none"> 1. Information Quality <ol style="list-style-type: none"> a. Content b. Format c. Accuracy d. Timeliness 2. System Quality <ol style="list-style-type: none"> a. Training b. Ease of Use c. Documentation d. Interface e. System Speed 3. Support <ol style="list-style-type: none"> a. In Sourcing b. Out Sourcing

4 Perceived Usefulness Factors

Various factors have been identified to influence end user's 'Perceived Usefulness' of the Hospital Information System. From the different extended TAM model reviewed, the literature by Pai & Huang

(2011) had categorize the factors according to the category of Information Quality, Service Quality and System Quality.

As for the extended EUCS in various literatures, numerous constructs have been proposed too and

similar to the extended TAM, two literatures had categorised the factors also based on the Information Quality, Service Quality and the System Quality Factor.

Further analysis of the factors for both 'Perceived Usefulness' and end user satisfaction are categorized in Table 3.

The three variables of Information Quality, Service Quality and System Quality are actually based on the Information System Success Model proposed by DeLone & McLean (1992). In the Information System Success Model, information quality can be related to the quality of the information system output namely the quality of the information that the system produce, while service quality associates with quality of service that the system is able to deliver. Lastly, the system quality evaluates the contribution of the information system to the organization.

Applying the Information System Success Model In proposing the relation between end user's 'Perceived Usefulness' and end user satisfaction that focus on Information Quality, Service Quality and Service Quality is one reasonable point of view. These three variables are more practical in evaluating the HIS because it evaluates the outcome

of the system itself instead of the external factors that support the system implementation namely the human characteristic and the organizational support. This also provides a fair evaluation as it can reduce the influence of an individual's subjective perception. Therefore when evaluating the implementation of the HIS in terms of 'Perceived Usefulness' and end user computing satisfaction, the factors related to human characteristic and organizational support should be omitted.

In designing the HIS, it is actually the task of the system designer team to take into account all of the consideration regarding the user and the organizational characteristic and subsequently design the system while catering with these characteristics. What users usually are looking for is that a system that successfully improve the user's quality of work, make the end user's job easier, save the end user time, and help to fulfil the needs and requirements of the end user's job. [7]. All of these can be evaluated based on the Information, Service and System Quality produced by the system.

Based on the Information, Service and System Quality factors, further expansion criteria and the related questionnaire are proposed as in Table 4.

Table 3 Categorized factor for 'Perceived Usefulness' and end user computing satisfaction

Information Quality	Service Quality	System Quality	Human Characteristic	Organizational Characteristic
'Perceived Usefulness' factors				
1. Output Quality 2. Results Demonstrability	1. IT Support	1. IT enabled innovations 2. Job Relevance	1. Individuals' fit to technology 2. Subjective Norm (Social Influence) 3. Image 4. User self-efficacy 5. Compatibility 6. Demographics 7. Social Influence	1. Top Management Support 2. Project team competency 3. IT support (Training) 4. Facilitating Conditions (training)
End user satisfaction factors				
1. Quality of output 2. Accuracy 3. Completeness 4. Up-to-date 5. Sufficiency 6. Understandable 7. Security 8. Standardized 9. Timeliness 10. Content 11. Format 12. Accuracy	1. In Sourcing 2. Out Sourcing	1. Ease of use 2. Functionality of system 3. Support 4. Security 5. Interface 6. Performance 7. Training 8. Documentation 8. System Speed	1. Perceived benefits a. User expectations b. Ease of use c. Perceived usefulness 2. User Background a. User experience b. User skills c. User involvement in system development	1. Organizational Support a. User attitude toward IS b. Perceived attitude of top management

Table 4 Information Success Model Factors and Criteria to Be Evaluated in The Evaluation of The Perceived Usefulness and The End User Satisfaction Criteria

Information Success Model Factors	Criteria to be evaluated	Proposed Questionnaires
Information Quality	Completeness	The HIS provides me with a complete set of patient information that meet my needs.
	Format	The information provided by the HIS is in a useful format.
	Accuracy	The information provided by the HIS is accurate.
	Timeliness	The HIS provides me with the most recent information on patients.
	Compatible	The information produce by the HIS can be easily integrated with other system.
Service Quality	Competent	The HIS service personnel is competent.
	Professional	The HIS service personnel is professional and have a good service attitude
	Accommodating	The HIS service personnel is accommodating in helping me to solve any problem encountered.
System Quality	Performance	The performance of the HIS is reliable. The HIS system can be integrated with other hospital support system.
	Interface	The HIS interface is user friendly.
	Function	The HIS function well according to its purpose.
	System Speed	The system speed of HIS is reasonably fast.

5 Conclusion

The element of 'Perceive Usefulness' from the HIS user holds a significant position that can determine the user acceptance of the system. As highlighted in the Technology Acceptance Model, there are few external variables which can influence the 'Perceived Usefulness' criteria. These external variables generally can be categorized into three categories of Information Quality, Service Quality and System Quality as in the Information System Success Model by DeLone and Mclean. This review shows that these three categories are also the prevalent factors that are often using in determining the Hospital Information Systems end user satisfaction. Hence the relationship between 'Perceive Usefulness' criteria and the End user Satisfaction can be related through the factors of Information Quality, Service Quality and System Quality. It is a fair approach to apply these three factors in evaluating end user 'Perceived Usefulness' and end user satisfaction of HIS without fully rely on human's subjective perception

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