A Conceptual IS Assessment Model for Public University in Malaysia

Mohamad Nor Hassan, Aziz Deraman

Faculty of Ocean Engineering and Informatics, Universiti Malaysia Terengganu, Kuala Terengganu, Malaysia

ABSTRACT

In the era of digital education, the role of Information System (IS) becoming critical a theme for public universities in Malaysia to embrace a change and offer an openness environment in delivering world-class education. The stakeholders require an input and a highly reliable mechanism to evaluate the success of IS solutions at post-implementation level From the context of Malaysia, previous study focus on theory of human behaviour to measure the acceptance of the solutions, and relatively few attempts to evaluate IS solutions based on the most relevant IS quality factors from the public university's perspective. Nonetheless, the measurement mechanism is still vague and subjective from the context of public Malaysian university. The aim of the research is to fill the void by proposing a generic model to measure IS success for public university in Malaysia.

Keywords: *Information System, IS Assessment, IS Success, Malaysia.*

I. INTRODUCTION

The digital education becomes a buzzword in modern educational transformation at the public university in Malaysia. The community in campus now is fully relying on the information system (IS) as a medium to redesigning the way work should be done for better support on the educational transformation. This transformation is fragmented from various areas ranging from the academic information system to e-Learning, which requires stakeholders to make an investment for IS as a continuum of events, in order to enhance its capabilities toward a paradigm shift and sustaining competitive advantage in global education market [1,69]. Nonetheless, Information technology (IT) department facing a challenging task [45] to provide an accurate result on measuring the success of IS investment to the stakeholders. The evaluation of what the success and actual impacts of IS realization in organization are still debated among the researchers [10,24,47,49] since the measurement mechanism still vague [10,49] and subjective [47]. Since the context, purpose, and impact of IS has evolved [47], the way university evaluates IS success must align with the current scenario, potentially creating substantial improvement from an existing assessment model used in a university environment in Malaysia.

Research in measuring IS success and investment has been on-going since the DeLone and McLean created an IS Success model in 1992 [2]-[7]. However, there is no standard model that is used consistently to measure IS success in various business domains since researchers addressed different aspects of measurement [2,8], constructs or dimensions of measurement IS success are varied [4,5] depending on what kind of IS domain. An unprecedented change in technological, business process and social makes the scope of IS measurement is very broad and varied. For instance, IS assessment model evaluate IS success from end- users, top management, IT/IS management, IT/IS team members, stakeholders, and other perspectives [9]. Sara and Rabiaa [10] stated, "…the measurement of information systems (IS) performance – which has puzzled many researchers and practitioners for a year – is both complex and elusive." In this context, there still an argument among researchers about formulating a generic IS success model to measure IS investment regardless of what type of IS solutions adopted in a business domain. The same issue needs to address in the context of public universities in Malaysia. The evaluation of IS investment at public university is still limited due the lack of an assessment approach to measure IS in terms of measurement dimensions, the use of standard metrics and the model have not fully tested [19]-[22]. Furthermore, the previous studies focus on the theory of human behaviour to examine the end-user acceptance towards the usage of IS solutions.

In addition, based on the preliminary investigation in a few public universities, no formal assessment has been carried out to evaluate the implementation of IS solutions at the post-implementation level. As a result, it is vitally essential to impart an appropriate IS success model that provides an unprecedented approach and roadmap for achieving common assessment pertaining to IS solutions across public universities in Malaysia. This study proposes a new model for assessing IS success for Malaysia's public university with reference to the information system (IS) success theory [2,5,9,10] and continuous improvement theory, which also known as Kaizen theory [13,14,16]. According to Nyugen et al.

(2015) [9], research for IT/IS success will refer to the term "information" as a core output of any IS used by organizations. IS theory used as fundamental knowledge for developing new model since its emphasis on the concept of communication and information arose from previous theory [17,18]. With respect to this model, a continuous improvement concept devotes as an additional guideline for formulating an appropriate and related items measurement for the model to measure IS solution at post-implementation level.

This paper has six (6) sections: (I) Introduction; (II) Theoretical perspective for research; (III) Literature review; (IV) Proposed model; (V) Contribution of Study; (VI) Conclusion.

II. THEORETICAL PERSPECTIVE

A. Information System (IS) Success Theory

IS theory providing a baseline for researchers that work on the IS success research. Generally, an information system (IS) is a collection of hardware, software, data, people and procedures that working together to produce information. Originally, IS theory was derived based on the identification of communication concept and its problem via Shannon and Weaver communication theory in 1946. In communication theory, Shannon and Weaver [18] classified message in communication system into three parts; i) technical level – refer to the efficiency of the system to produce information; ii) semantic level – refer to the intended meaning of information system generated. iii) effectiveness level – the effect of the information to the receiver. Based on this theory, in the era of the information age, Mason [17] put an initial effort to measure IS by adopting theory in [18], and changed the effective level into influence level, which IS can be measured as a hierarchical of the event. At International Conference on Information System (ICIS) in 1980, Peter Keen [23] raised on issues related to the need of dependent variables to measure information from Management Information System (MIS) field, reflecting the commitment to establish IS theory.

Based on issued raised by Keen, DeLone and McLean [2,5] conducted extensive research by reviewing over 600 articles and over 140 studies to address the issues of measuring IS success, and finally develop an approach for MIS success. By leveraging theory developed by Shannon and Mason (1949) respectively, with an extensive review from various empirical studies, DeLone IS success model was first released in 1992 to measure IS success. The six dimensions/categories IS measurement had identified (Figure 1); System Quality, Information Quality, Information Use, User Satisfaction, Individual Impact, Organizational Impact.

Figure 1: DeLone and McLean IS Success Model [2]

DeLone and McLean (1992) categorized these dimensions/constructs into three (3) levels. For technical level, its posited System Quality and Information Quality, influence level posited System Use and User Satisfaction, finally for effective level posited Individual Impact and Organizational Impact. The model can be viewed from two (2) perspectives; i) the interdependence between the constructs, ii) the causal relationships between these constructs. The model generating a better understanding for researchers to further strengthen research in MIS field.

The model was empirically validated in various domain. IS researchers giving feedback and critique for this model [3,5,24,25]. Seddon [3] tries to re-evaluate and make the extension of the model since he found there is an ambiguity exists in defining the construct of "Use". In addition, the "System Use" construct cannot be assumed as a critical success factor in measuring IS Success since it reflects the behaviour rather than a success measure. Pitt et al. [25] evaluated the model and made a recommendation to include Service Quality as a construct measurement since the current model is a product-oriented assessment without compromising from a service provider perspective. Based on these feedbacks, DeLone and McLean (2003) [5,24] updated the model by adding Service Quality construct, add Intention to Use as an alternative to System Use, combined Individual Impacts and Organizational Impacts into single construct known as Net Benefits since IS impact comes from various aspects such as workgroup impact, industry impact, consumer impact, and societal impact. Updated DeLone and McLean (2003) model consists of six (6) antecedents for IS Success model (Figure 2). The updated DeLone and McLean (2003) model had been used by researchers either by extending the model or adding new measurement constructs that meet certain criteria in IS environment [6,7,19,21,26,27].

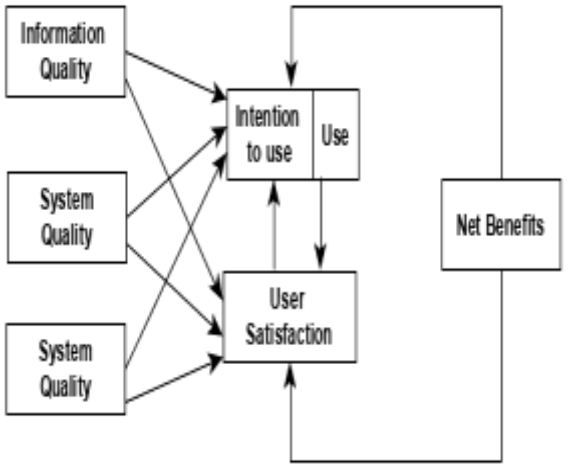

Figure 2: Updated DeLone and McLean IS Success Model [24]

B. Continuous Improvement and Quality Concept

Continuous improvement (CI) is one of the very important aspects in IS post-implementation level. IS solutions become the stage of maturity after a certain period of time the solutions being deployed into the workplace environment. There is various definition given to the term continuous improvement. According to Sanchez and Blanco (2014) [32], continuous improvement is a cycle process which involves the constant activity that must be done from time to time that associates all people in the organization, ultimately to improve and eliminating the wastes. The CI concept is the improvement activity that aims to increase successes and reducing failures. [33]. The CI becomes an important issue in IS field in terms of products, services or both. The concept of CI was originated from the concept of continuous improvement or also known as the Japanese concept of Kaizen [14]. The history of Kaizen begins after World War II where Toyota was the first to implement the quality concept in the production process [13,30].

Formally, Masaki Imai introduced Kaizen concept in 1985 to assist western companies for issues related to quality [30]. The word Kaizen originated from two (2) Japanese ideogram; "kai" means change and "zen" means to improve [13]. Kaizen provides a systematic effort and acts as an incremental process to consistently promote continuous improvement in various domain. CI concept always reflects on the term quality. Previous studies have identified many factors that implementation of CI or Kaizen. Among the important components for the CI process are management commitment, customer focus, training, communication process, organizational culture, documentation, and evaluation [43,44]. A systematic literature study carried-out by Carnerud et al. (2018) [38], describes that Kaizen offers a benefit when implementation practically takes place accordingly. The outcome of their analysis showed that Kaizen will improve communication within any levels of employees and can contribute to the process improvement.

Generally, the concept of quality is conformance to the requirement [14,29]. However, the definition of quality can be interpreted in many ways. ISO 9000 [28] defines quality as "the totality of features and characteristics of a product or services that bear on its ability to satisfy stated or implied needs". IEEE defines the quality as the degree to which the system, components, or process meets customer satisfaction [29]. Juran [11] defines quality as "fitness of use". As per today, the term "quality" becomes a competitive factor for the customer to buy the product, to engage certain services and procure something for business purposes. Based on the 14 points underlying by Deming with regards to quality management [31], the concept is to create an eco-system in the organization that emphasizes on cooperation and learning to continuously improve the process, products, services, employee continual development, which can increase customer satisfaction. Juran definition of quality tends to look from customer evaluation of the products or services. It is relatively defining from the aspect of customer needs and expectations. In order to support his definition, Juran [11] stated that "the goods and services that an organization to produce must meet its customer". This statement indicates how to manage quality and continuously improve the quality, finally meeting customer expectation.

To summarize the concept, CI becomes one of the important criteria that yield the success of IS solutions at university. It offers as a part of an indicator to determine on-going potential improvements of IS solutions and justify the present investment in IS solutions. From a quality perspective, quality becomes a driver factor toward customers' satisfaction. Hence, IS solutions must persistently produce a high quality IS by meeting the requirements and achieve customer expectation. Ironically, such IS solutions can be measured and evaluated gradually based on the quality concept such as the degree of the attainment of IS solutions, customer satisfaction, continual improvement (based on Kaizen concept), quality of services, performance, and user quality. For the organization to develop high quality IS solutions and services at a competitive price for customers, it requires a multidimensional approach to meeting customer expectation. Indeed, the success rate of IS highly based on how well the quality concept has been adopted and well managed for IS implementation, followed by the on-going continuous improvement activities at a post-implementation level. In summary, the research will be based on the IS success theory with the continuous improvement and quality concept.

III. LITERATURE REVIEW

A. Technology Acceptance Model (TAM)

Technology Acceptance Model (TAM) was created by Fed Davis in 1989 [50]. The purpose of this model is to evaluate the behaviour of end users to use and accept new technology implemented in the organisation. The model is based on the theory of reasoned action (TRA) and Theory of Planned Behaviour (TPB) [48]. The theory is based on the two determinant factors; attitude towards a behaviour and subjective norm [51]. An attitude towards a behaviour refers as an individual feels the positive or negative feeling when executing the target. Subjective norm refers to the person perception think that the individual should or should not perform the behaviour in the question [50,52]. The researcher using the TRA model to predict the human intention behaviour toward performing specific task (Figure 3).

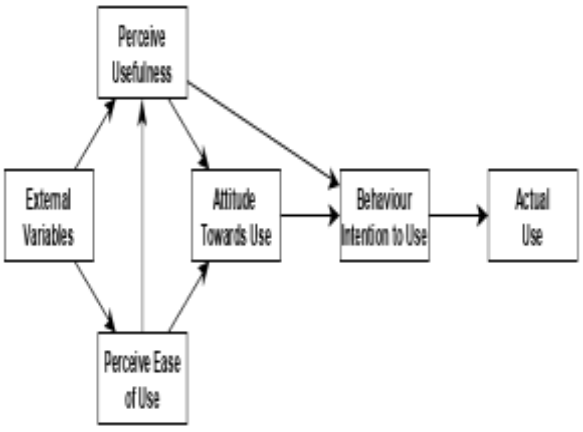

Figure 3: Technology Acceptance Model [54]

Further development takes place to improve an existing model. Venkatesh and Davis [53] proposed TAM 2 in the year 2000. The researchers introducing additional variables that might directly influence the antecedents of TAM parameter for perceive usefulness (PU), based on the previous study [50,55]. Venkatesh et al. [57] extend an existing user acceptance model with the aim to harmonize an existing model in computer assessment field and produced a model known as the unified theory of acceptance and use of technology (UTAUT). Due to the lack of management role in getting input for IS investment, Venkatesh and Bala [56] developed TAM3. Although TAM offers a basic concept of technology acceptance among the users, based on seventy-nine (79) empirical studies [58], it concludes that construct for perceive usefulness (PU) and perceive ease of use (PEU) less likely correlated to the actual usage of the system.

Based on the review from various main technology acceptance models, the study foresees that these models are more dominant in measuring how the perception and the acceptance of the technology from the human being psychology perspectives [48,50,55,59,60] without taking into consideration other external factors such as technologies, business and organizational requirements. The scope of technologies measurement from TAM, TAM 2, UTAUT, TAM 3 and others technology acceptance model is solely limited to the theoretical model towards behavioural approach and do not cover most dominant aspects that require to evaluate IS success.

Table I. Summary Finding from Previous Study

Author	Title	Issues/Ideas Addressed In Research	Limitation
W. M. Al-Rahmi et al. (2018) [83]	A model of factors affecting learning performance through the use of social media in Malaysian higher education	1. The study attempts to investigate the acceptance of research students' using social media in learning. 2. Using nine (9) constructs that depict the teaching-learning process and user behaviour towards achieving satisfaction on social media. 3. Model derived from TAM and Constructivism theory.	1. The model evaluates success of social media solely using behavioural approach. 2. Model do not measure social media comprehensively without taking into account other aspects; technological, service and others. 3. Not appropriate to evaluate IS solution in total.
F. D. Saiful Bahry et al. (2012) [86]	Predicting intended to use of web portal using extended technology acceptance model (TAM): Some perspective on information management students	1. This study tends to evaluate the Web portal in term of usage at University Technology Mara (UiTM). 2. Use five (5) constructs that fully based on the concept of behaviour theory. 3. Model derived from TAM model.	1. The model does not fully measure portal from various perspectives since it focuses on the use of web portal. 2. Model needs to be expanded and integrated with other IS model in order to evaluate Web portal and other IS solutions comprehensively.
Arshad et al. (2015) [20]	The influence of information system success factors towards user satisfaction in University Technical Malaysia	1. Investigate the influence of IS success factors toward user satisfaction at UTeM. 2. Used four (4) constructs to measure user	1. Specifically focus on individual measurement. 2. Does not consider other IS success factors that are relevant from

	Melaka	satisfaction toward the use of Information System; i) System quality, ii) Information quality, iii) Service quality, iv) System use. 3. Model derived from DeLone & McLean IS Success model.	the Malaysia's public universities. 3. Do not describe details metrics/items used for pre-defined constructs. 4. Do not implement details the derivation of calculation of user satisfaction index or rating.
Hassan et al. (2017) [19]	Developing a success model of Research Information Management System for research affiliated institutions	1. The study proposed a conceptual IS success model for Research Information Management System (RIMS) at Universiti Teknologi Malaysia (UTM) for individual and organisation measurement. 2. Proposed a measurement based on three (3) aspects; Technology, Organizations, Human. 3. Use eight (8) constructs for measurement of IS; i) System quality, ii) Information quality, iii) Service quality, iv) top management support, v) operations enablement, vi) computer self-efficacy, vii) user experience, viii) performance expectancy. 4. Model derived from DeLone & McLean IS Success model.	1. This is only the proposed conceptual model to evaluate IS at public university. 2. The model has not been validated. 3. Do not describe details metrics/items used for pre-defined constructs. 4. Must be validated through few case studies in order to find the suitability and generality of the model when evaluating IS's solutions from different universities.
S. Ghavifekr & Hazline Mahmood (2015) [28]	Factors affecting use of e-learning platform (SPeCTRUM) among university students in Malaysia.	1. The aim of the study is to investigate factors affecting the use of e-Learning (SPeCTRUM) at University Malaya. 2. Use six (6) constructs to find the usage behaviour of using e-Learning; 1) System quality, 2) Information Quality, 3) Use, 4) User Satisfaction, 5) Behaviour intention, 6) Use behaviour. 3. Twenty-one (21) metrics was used for the measurement. 4. Model derived from UTAUT, DeLone & McLean IS Success model and Web-Based Learning Environment Inventory.	1. Focus to reaffirm the factors that affected students to use e-Learning. 2. Does not provide a comprehensive coverage when researcher plans to evaluate the success of e-Learning from various perspective; technical, services, usage, others. 3. More case study is required to further validate the model in different type of e-Learning environment.

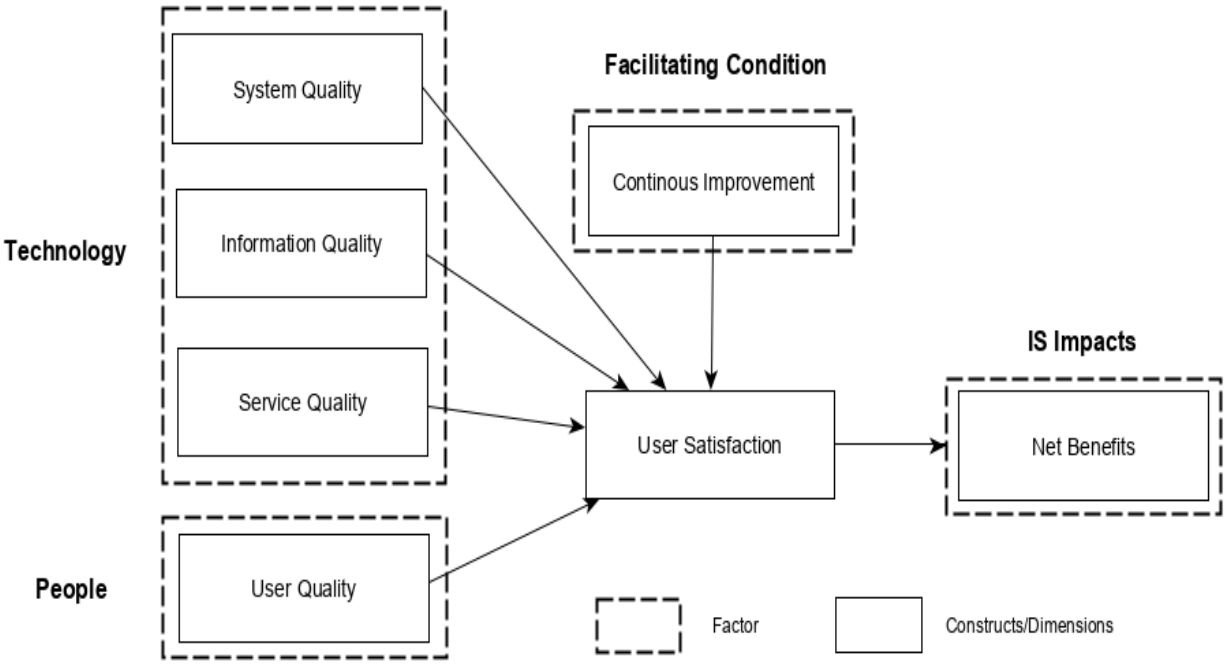

Figure 4. Proposed Conceptual Research Model

A. Related works for Evaluation of Information System (IS) from Malaysia's Perspective

IS assessment research has been extensively explored by researchers and practitioners. For the public university in Malaysia, most of the previous study using TAM model [61,63,64,65,66] and IS Success model [19,20,21,62,67,68,70] to factors that affect users using the IS solutions. Most of the study case study evaluating an e-Learning system and few studies formulate a model to evaluate other information systems. Most notably, no standard model or mechanism is available for a public university to evaluate the success of IS at a post-implementation level. Table II shows the summary finding from the previous study obtained from primary sources

IV. PROPOSED MODEL

In this research, the derivation of research model comes from the concept of IS Success [2,4,5], related theory [2,3,5], review of aforementioned previous models and empirical studies [6,7,19,20,28,34,46,83], and prior conducting preliminary investigation on IS assessment at public university. Using updated DeLone and McLean [2,5] as a baseline model and related inputs, this study will formulate an IS model to measure the success of IS mainly implemented and used by the end-users to support universities daily business processes. The assessment of IS decomposed into three (3) categories; i) Technology, ii) People and iii) Facilitating Conditions. The model encompasses a comprehensive representation of seven (7) measurements constructs/dimensions as a component to evaluate what IS success embodies in the context of a public university and presented in Figure 4.

Details definition of each construct/dimension are as follow;

A. System Quality (SYQ) – Technical aspects of IS representing the performance of IS in terms of reliability, performance, functionality, usability, convenience to access, response time, flexibility and stability of the system [4,5,6,7,19,26,36,41].

B. Information Quality (IFQ) – The quality output produced and generated by IS [4,5,6,7,26,27,36,41].

C. Service Quality (SVQ) – The effectiveness and the readiness of IS services support receive from IS personnel [5,7,19,25,26,36,37].

D. User Quality (USQ) – The tendency and effectiveness of end-users to use the IS solutions affected by various attributes [19,39,40,41].

E. Continuous Improvement (CQI) – Based on the Kaizen concept, to measure the application of CI upon implementing and deploying IS solutions at workplace [13,14,43,44].

F. User Satisfaction (USS) – The degree of how well the expectation and satisfaction of end-users when using IS solutions [5,7,19,36,37].

G. Net Benefits (NEB) – This is the total benefits what the IS solutions can offer to the individual

and organization when it is implemented and use within the university [5,6,7,26,42].

V. EXPECTED OUTCOME OF THE STUDY

There is no formal and generic mechanism for public universities in Malaysia conducting the assessment of IS solutions in term of success level for IS investment. Therefore, it is imperative to explore this issue by having a standard model applicable to evaluate IS adoption at various public universities. The first contribution of the study is to identify the actual quality factors/constructs that will affect the measurement of IS success in public universities across Malaysia. Secondly, with the identification of these qualified quality factors, the most relevant measurement items (metrics) is selected for each identified quality factors for the purpose of measurement. For the third contribution, the development of a generic IS assessment model that relevant in measuring the success of any types of IS solutions from the context of a public university, which comprises different perspectives in relation to technological, people, and facilitating conditions that relevant from university context. Finally, an assessment tool will be developed in order to validate the proposed model.

VI. CONCLUSION

Public universities in Malaysia invest a huge amount of money to establish new or improving an existing IS solutions to adapt and embrace change in providing an openness environment towards the era of digital education. From university stakeholders' perspective, they need to know how well the success of such IS investment to the university. Nonetheless, no formal approach exists for evaluating the success IS implementation at a post-implementation level. Amidst this scenario, this study aims to propose a generic IS assessment model, which eventually can act as a blueprint for a university to perform an evaluation process to determine the degree of success for IS investment for various IS solutions at the university. Using a set of valid questionnaires, the survey process will take place at public universities with the aim to obtain actual empirical data from users. The statistical techniques using Structural Equation Modelling (SEM) [35] will be employed to analyse and examine whether the IS assessment model fit for each pre-defined measurement construct. Then, the development of IS assessment tool will take place for further evaluation of the research model via case study at university. Finally, an IS experts from industry will evaluate this tool and provide feedback to reaffirm the reliability of the model to be used for IS evaluation purpose.

ACKNOWLEDGEMENT

The author would like to acknowledge Malaysia Ministry of Education and Research Management Center at University Malaysia Terengganu (UMT) for funding the grant with the reference code FRGS/1/2019/ICT01/UMT/01/1 to pursue research in this field. Lastly, the author like to thank the Faculty of Ocean Engineering Technology and Informatics for supporting the research.

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