Integrating the Readiness and Usability Models for Assessing the Information System Use

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***Abstract*—In the systematic view, the use of information system (IS) can be separated into three main parts, i.e., the users as the actor of the use, the use itself as a process, and the system as the used object. However, most of the usability studies focus on the process and object points. The number of scholars who study about the actor of the use is still rare. This is an interesting phenomenon how to develop a comprehensive model which combining the three parts of the above-mentioned parts of the systematic perspective. The purpose of this study was to understand the influential relationships between the readiness and usability factors towards the use of IS and to integrate the readiness and usability models in the context for assessing the use of a new IS. The proposed model was developed by adopting the Parasuraman's readiness model and the Nielsen's usability model, in terms of an input-process-output (IPO) logic. Besides the placement transparency of the ten variable within 25 influential relationships, the study also demonstrates coherently the definitions of the variables, its indicators, and the questions of each item measurements.**

Keywords— Combination model; readiness; usability; system use model; IPO logic.

I. INTRODUCTION

It is clear that the efficiency and effectiveness in completing tasks or jobs in the business process are two indications of the IS success effects [1-5]. In addition, it can also clearly seen that in order to achieve the success level; the IS owners have to use the system itself. Therefore, it is why the system use factor has been one of the variables which affect significantly the success dimension in the processional and causal model of IS success model [5-8].

In the systematic perspective, the use of a system can be separated into three main parts, i.e., the users as the actor of the use, the use itself as a process, and the system as the used object. Most of the previous usability studies indicated to focus on the process and object points, e.g., the learnability, efficiency, memorability, reliability, and the satisfaction points [9, 10]. It is still a limited number of scholars who study about the actor of the use. Thus, this is interesting phenomenon how to develop a comprehensive model which combining the three parts of the above-mentioned parts of the systematic perspective.

The purpose of this study was to understand the influential relationships between the readiness and usability factors towards the use of IS and to integrate the readiness and usability models in the context for assessing the use of a new IS. In respect of the above-mentioned purposes, two research questions were then proposed to guide the study implementation, i.e.:

Q1. How to understand the relationship between the factors of the readiness and usability models in terms of the use of an IS?
Q2. How to integrate the readiness and usability models in terms of the use of an IS?

Sequentially, this paper is written in five steps. The second part describes the literature review about the related works and the basic theoretical framework used in the study. It is then followed by the demonstration of the methodological parts of the research implementation in the third step. The fourth step explains the results and discussion part of the study. Lastly, the paper is then concluded by the conclusion part in the fifth step.

II. LITERATURE REVIEW

The technology readiness index (TRI) measures individual readiness in using technology through positive and negative variables about technology in general, being a very powerful variable of intent and behavior associated with the application of technology, especially in e-services domains [11, 12]. Parasuraman described that users tend to adopt and integrate new technologies to achieve desired goals in terms of work. Readiness in terms of technology application is seen from the four existing co-dimensions [11]. The TRI-index measures the readiness of users to new technologies through four variables. i.e., (1) optimism, positive view of technology and the belief that technology can improve control, flexibility, and efficiency in life; (2) innovativeness (innovation), is a tendency in the use of new technology products or services; (3) discomfort (discomfort), have an attitude of not receiving and tend to overwhelm and not confident when in touch with new technology; and (4) insecurity (insecurity), have suspicion of technology security and personal data security reasons.

Subiyakto [12] combined the above-mentioned model and the DeLone and McLean's [6-8] IS success model for assessing the readiness and success of IS integration success. The scholar inspired by the Lin's et al. [13, 14] technology readiness and acceptance (TRAM) model.

The level of competence of IS users becomes the main factor in determining the success in adopting a technology. Environments with high levels of information technology mastery usually adapt faster to the presence of new information systems, so that the implementation of new information systems tends to be easier than in environments with reverse conditions [15, 16]. Optimism and Innovation are the determinants of the Technology Readiness Index, and other variables are inhibitors [11, 17].

Similar to scholars [13, 14], another research is done to find out the relationship between the technology acceptance model (TAM) with TRI by Godoe and Johansen [18]. The results of the research found that optimism and innovativeness significantly affect perceived usefulness and perceived ease of use and perceived usefulness have a significant positive effect on actual usage. Similarly, Tsourela and Roumeliotis [19] examined the role of technology, sex and age readiness in the acceptance and actual use of technology-based services. They found that the variable was the effect of the determinants on existing behavioral intent and actual use.

In addition, the usability model is a conceptual view that puts focus areas to show the usefulness of existing software [20]. This criterion is helpful in evaluating the usefulness of the software system. There are various usability definitions from various sources, according to the Axup's [21] descriptions, usability is a measure of a characteristic that describes how effectively a user interacts with a product. Usability is also a measure of how easily a product can be learned quickly and how easily a product can be used.

According to Madan and Dubey [22], describes some matters concerning usability:

- Learning Ability, some questions concerning learning ability are how easy it is to learn a system and how fast to master to become proficient?
- Benchmark Outputs, some questions concerning benchmark output (throughput) is how fast a task is done and how many people are needed to correct the error?
- Flexibility Some questions concerning flexibility are how much the system matches the skills of a user and can the system be altered to meet different work paths or different levels of skill?
- Behavior (Attitude) Questions concerning behavior (attitude) Is a user satisfied with the system? Does the user benefit greatly from the system and How long the system is used in the agency?
- Error Level The error rate is undesirable and is something to be minimized.

Nielson [23] suggests five aspects of usability or five usability attributes namely:

- Easy to learn (learnability): the system quality that shows whether the system easy to learn and use in completing a particular task.
- Efficiency: the way in which a system can support a user in doing his job, has simple steps to get the same result.
- Easy to remember (memorability) is defined how the user's ability to retain knowledge after a certain period of time, the ability is obtained from the laying of the menu is always fixed.
- Errors and security (errors) are defined how many errors made by the user, user-generated errors include the mismatch of what the user thinks with what is actually presented by the system.
- Satisfaction is defined as the freedom from discomfort, and a positive attitude towards the use of a subjective product or measure as the user feels about the use of the system.

In the usability engineering, Nielsen [23] suggests five qualities of a usable product: learnability, efficiency, memorability, errors (low rate, easy to recover), and satisfaction. For his own list, he decided on:

- Effective: the completeness and accuracy with which users achieve their goals.
- Efficient: the speed (with accuracy) in which users complete their tasks
- Engaging, how pleasant, satisfying or interesting a product is to use
- Error-tolerant: the ability of the interface to prevent errors or help users recover from those that occur
- Easy to learn: how well the product supports both initial orientation and deeper learning.

III. RESEARCH METHOD

This model development study was carried out through its four main stages (Fig. 1), as it is presented by the prior model development studies [2, 12].

Firstly, the authors observed the system use phenomenon in the sampled institutions and reviewed a number of the usability literature in order to develop the research programs and to initiate the theories or models, in terms of the study initiation (Table I).

Secondly, the model development was then performed based on the developed assumption [2, 12] in regard to the readiness [11] and usability [24] constructs. The assumption then became the basis of the adoption, combination, and adaptation the selected theories and models. The result was the model draft (Fig. 2).

Thirdly, the result of the model development stage was then broken down into the operationalization stage. In this stage, the researchers defined the variables and indicators in the first and second sub-stages, and then developed the questions of each item measurement by considering the study context.

Lastly, the study implementation was then reported. As it is elucidated in the paper, the proposed draft model is consisted out two main parts, i.e., the developed model itself and its list questionnaire questions (Table IV).

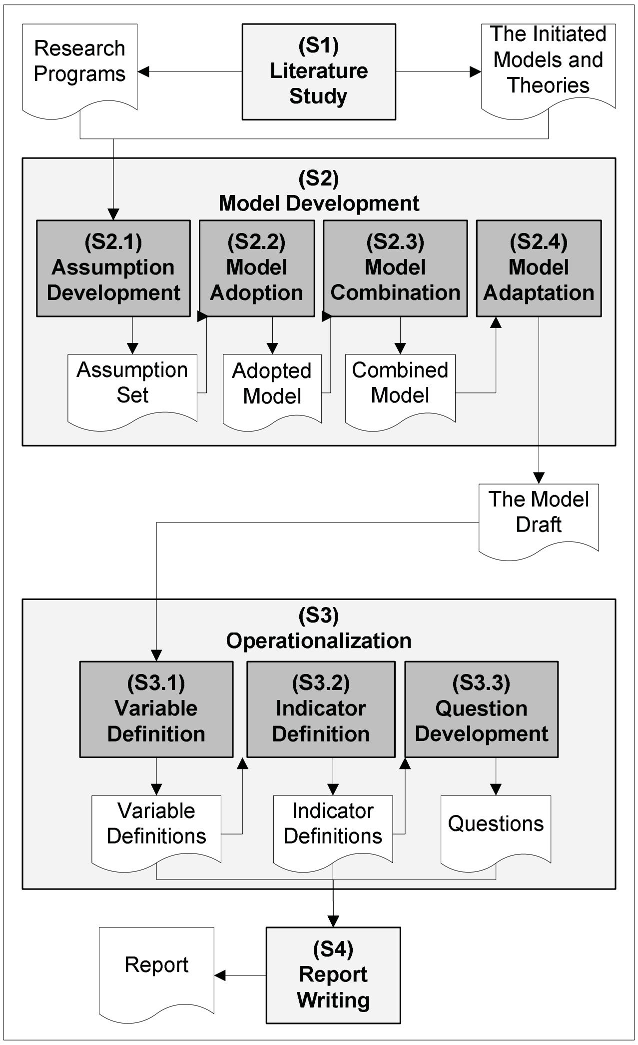

Fig. 1. The research procedure

TABEL I
LIST OF THE BASIC MODELS AND THEORIES

The Basic Models and Theories	References
Information processing theory	[25]
Technology readiness model	[11]
Usability model	[24]
Processional and causal models of a model development	[2, 7, 12, 26, 27]

IV. RESULTS AND DISCUSSION

The model generated from the incorporation of the Parasuraman's [11] readiness model and the Nielsen's [24] usability models. Fig. 2 shows the proposed model with its ten variables and 25 relational hypotheses.

Following the assumption of the Davis's input-process-output (IPO) logic, the variables of the Parasuraman's [11] readiness variables (i.e., Optimism [OPT], Innovation [INV], Discomfort [DCF], and Insecurity [ISC]) were placed in the input dimension of the model. On the other sides, the Nielsen's [24] usability variables Learnability [LRN], Efficiency [EFC], Memorability [MMR], Error/Reliability [RLB], Satisfaction [STF]) were positioned in the process dimension and System Use (SYU) in the output dimension. The authors extended the error variable of the Nielsen's [24] usability model into the reliability variable in order to propose the adopt the trust and quality expectations of the IS as a product (Q1).

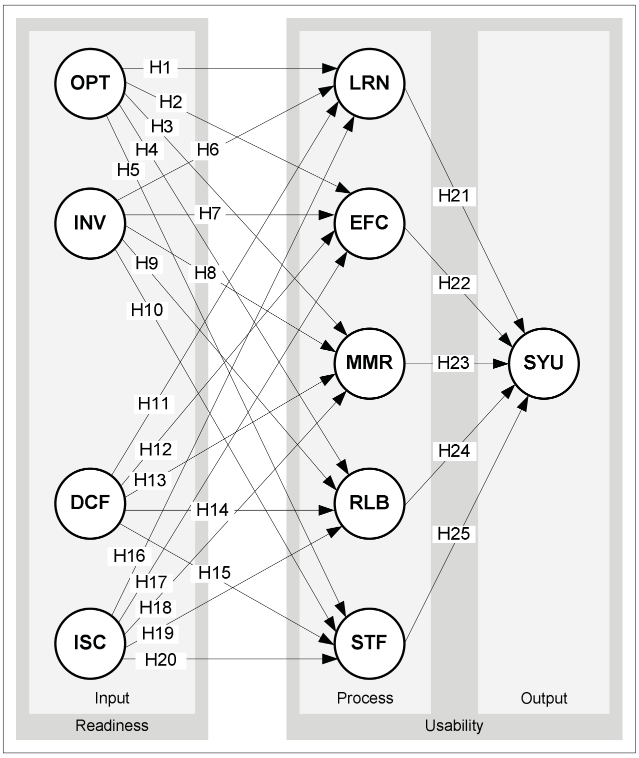

Fig. 2. The proposed readiness and usability model

In respect of the IPO logic [25] and the processional and causal models of a model development [2, 7, 12, 26, 27], the 25 relational hypotheses were then developed in order to demonstrate the influential relationships among the models (Fig. 2). Overall, the employment of the logic combines both models within a rational presentation. Table II, III, and IV elucidate the definitions of the variables and indicators of the model and the proposed questions respectively (Q2).

TABEL II
LIST OF THE VARIABLES AND ITS DEFINITIONS [11, 12, 24]

Var.	Definitions
OPT	The degree to believe that the IS will probably happen.
INV	The degree to see that the IS is the advanced degree of the system.
DCF	The degree to perceive that the IS is an uncomfortable thing.
ISC	The degree of distrust that an IS integration is able to be implemented properly and concerns about its potentially harmful consequences.
LRN	The degree of easy is it for users to accomplish basic tasks the first time they encounter the IS integration.
EFC	The degree of users have learned the IS integration, how quickly can they perform tasks.
MMR	The degree of users return to the design after a period of not using it, how easily can they reestablish proficiency.
RLB	The degree about system service helpdesk is reliable when needed.
STF	The degree of how pleasant is it to use the design.
SYU	The degree of expected results in the determination of SI integration that are useful and acceptable to users.

TABLE III
LIST OF THE INDICATORS AND ITS DEFINITIONS [11, 12, 24]

Indicators	Definitions
Easiness (OPT1)	The degree related to the ability of a system for providing a freedom from the constrains, difficulties, and troubles.
Connectivity (OPT2)	The degree related to the ability of a system to connect successfully with other systems.
Efficiency (OPT3)	The degree related to the system achievement to produce an output compared to the resources needed to achieve the output.
Effectiveness (OPT4)	The degree related to the system capability to achieve its utilization goals.
Productivity (OPT5)	The degree related to the system support for producing output compared to the resources needed to produce the output.
Problem Solving (INV1)	The degree related to the system support for finding solutions to problems.
Independence (INV2)	The degree related to the system ability to support its users free from the controls or influences.
Challenge (INV3)	The degree related to the system support to successfully deal with or achieve something within a difficult situation or problem.
Stimulation (INV4)	The degree related to the system support to encourage something to happen, develop, or improve.
Competitiveness (INV5)	The degree related to the ability of a system to support the users to be more successful than their competitors.
Complexity (DCF1)	The degree related to the system features that confusing or difficult to be understood.
Difficulty (DCF2)	The degree related to the condition of a system which it is unable to be operated easily.
Dependence (DCF3)	The degree related to the condition of a system which needs the other parties to operate it.
Lack of Support (DCF4)	The degree related to a system which it does not have any, or enough, of the support in its operation
Inappropriateness (DCF5)	The degree related to the state of being inappropriate.
Failure (ISC1)	The degree related to the possibility that a system unpleasant or dangerous might happen.
Threat (ISC2)	The degree related to the system situation that could cause harm or danger.
Reducing Interaction (ISC3)	The degree related to the system implementation which makes human interactions become less in size, amount, and importance.
Distraction (ISC4)	The degree related to the system utilization gets attention and prevents people from concentrating on something else.
Incredulity (ISC5)	The degree related to the system hesitation of its utilization.
Ease of use (LRN1)	The degree related to the system is easy to use.
Simplicity (LRN2)	The degree of the system is very simple.
Effectively (EFC1)	The degree of the system works effectively.
Quickly (EFC2)	The degree of the system quickly completes the job.
Efficiency (EFC3)	The degree of the system works efficiency.
Understanding (MMR1)	The degree of the information in this SI is easy to understand.
Functionality (MMR2)	The degree of commands is aligned to specific functions.
Convenience (MMR3)	The degree of hierarchical of the interface is simple to understand.
Availability (RLB1)	The degree of the system is always available to operate when needed.
Protectivity (RLB2)	The degree of the system is protected from physical access from non-authoritative rights.
Maintenance (RLB3)	The degree of the system is easy to maintenance.

TABLE III (*Continued*)
LIST OF THE INDICATORS AND ITS DEFINITIONS [11, 12, 24]

Accuracy (RLB4)	The degree of the system processing is complete, accurate, and timely.
Clearly (STF1)	The degree of the information provided is very clear.
Easily (STF2)	The degree of the system is ease in finding the information needed.
Satisfaction (STF3)	The degree of navigation in the interface is satisfactory.
Appropriately (STF4)	The degree of input method is appropriate.
Obviously (SYU1)	The degree of the organization of information on the system screens was clear.
Pleasantly (SYU2)	The degree of the interface of this system was pleasant.
Likely (SYU3)	The degree of like using the interface of this system.
Expectation (SYU4)	The degree of the system has all the functions and capabilities expect it to have.
Excitement (SYU5)	The degree to the overall conclusion that degree about satisfied with the system use.

TABLE IV
LIST OF THE QUESTIONNAIRE STATEMENTS [11, 12, 24]

Statements of the questionnaires
OPT1-System is free from the constrains, difficulties, and troubles.
OPT2-System can be connected easily with other systems.
OPT3-System operates with the minimal resources.
OPT4-System operates within the maximal output.
OPT5-System is able to be operated efficiently and effectively.
INV1-System is a problem-solving tool for users.
INV2-System helps users to be free from the controls or influences.
INV3-System supports users for achieving goals in a difficult situation or problem.
INV4-System encourages users for achieving goals.
INV5-System supports users to be more successful than their competitors.
DCF1-System confuses users in its operation.
DCF2-System cannot be operated easily.
DCF3-System cannot be operated freely.
DCF4-System is operated without a full support operation.
DCF5-System is inappropriate to its development planning.
ISC1-System is unsuccessful be operated appropriated to its development planning.
ISC2-System is in a situation that could cause harm or danger.
ISC3-System makes users become less in interactions.
ISC4-System makes users be unfocused about their importance.
ISC5-The system is dubious to use.
LRN1-The system is easy to use.
LRN2-The system is very simple.
EFC1-The system gets the job done effectively.
EFC2-System quickly completes the job.
EFC3-The system gets job done efficiently.
MMR1-The information in this SI is easy to understand.
MMR2-There commands are aligned to specific functions.
MMR3-There hierarchical of the interface is simple to understand.
RLB1-The system is always available to operate when needed.
RLB2-System is protected from physical access from non-authoritative rights.
RLB3-The system is easy to maintenance.
RLB4-The system processing is complete, accurate, and timely.
STF1-In this SI, the information provided is very clear.
STF2-In this SI there is ease in finding the information needed.
STF3-There navigation in the interface is satisfactory.
STF4-The input method is appropriate.
SYU1-The organization of information on the system screens was clear.
SYU2-The interface of this system was pleasant.
SYU3-I like using the interface of this system.
SYU4-This system has all the functions and capabilities that are expected.
SYU5-Overall, I am satisfied with this system.

In terms of the perspectives of the model development [27, 28], the study demonstrates two highlighted points, i.e., the trust and validity issues.

First, the study implementation was carried out transparently, as it is described in the research method section. The readers can see how the authors employ the development assumptions, adopt the readiness [11] and usability [24] models, combine both models, and adapt the variables, indicators, and questions, in terms of the system utilization constructs. In short, it can be clearly seen that the clarity of the model development process study may indicate the trust point of the development.

Second, besides the utilization of the assumptions, adoption, combination, and adaptation processes, the reader can also be seen how the questions can be retrieved inversely referring to the indicators, variables, and the assumptions parts. Subiyakto et al. [27] who refer the Eddie's [28] et al. descriptions indicated that the model validity point is how the model can present the real phenomenon. It can be done by employing the inverse retrieval from the model development process. I brief, the cohesive interrelation among the proposed model and the question measurement may present the validity point of the model.

In summary, it is clear that the transparency of the model development process and the rationality of the developed model may two contributions of the study. On the other side, it may also clear that the use of the other understanding, assumption, and perspective points will indicate the different model proposition. The points may be one of the study limitations. Thus, it is recommended that besides the examination studies may still be needed to be done for assessing the model and its research instrument, the limitations will also become the consideration points for the future works.

V. Conclusion

The study shows how to understand the relationship between the factors of the readiness and usability constructs in terms of the use of an IS and how to combine the readiness and usability models in terms of the system use. The authors propose a combination model by integrating the four variables of the readiness model and the five variables of the usability models, in terms of IS use assessment. Besides the clarity development process, the coherent relationship among the model, variables, indicators and the questions of each indicator is also presented in the paper. In regard to the study limitations around the understanding, assumption, and perspective issues of the authors; besides the limitations are recommended to be the consideration points for the future works, the proposed model, and its instruments are also recommended to be continued into the examination stages.

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