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EVALUATION MODEL FOR INFORMATION SYSTEMS BASED ON SYSTEM QUALITY FACTORS: FROM A SYSTEM DEVELOPER PERSPECTIVE

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Abstract:

Information system (IS) is seen to be one of the major factors that operate the organization systematically and has contributed a positive impact in improving the performance of an organization. Due to its importance, many studies have done in ensuring the best method employed in its development and comply with its quality. The challenges are to identify a method in evaluating the quality of the systems and this has become the interest of many researchers. There are various evaluation models exist, in fact, various evaluation theories have been proposed in different disciplines and perspectives. However, the existing evaluations are based from the user's perspective and often ignored the point of view from the system developers. System developers are the persons who are responsible to develop the system. They are responsible in ensuring the systems comply with its quality and making the system usable, effective and error free. System developers also ensure that the developments are according to the user specifications. Therefore, their views in determining the quality of the system should be taken into account. Thus the aim of this study is to propose an evaluation model for IS based on system quality factor from the perspective of system developers. The findings showed that the system quality factors such as data quality, user satisfaction and organizational needs are the factors that should take into account when proposing IS evaluation models. The findings from this study could be served as a guideline to the system development team in producing quality systems that are able to enhance organizational performance.

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Keywords:

IS Evaluation Model, System Quality Factors, Organizational Performance, System Developer Perspective

Introduction

Information Systems (IS) have a positive impact on the organizations performance. Developing a system that complies with the quality standard is important in order to effectively support the strategic planning of the organization (Sudirman & Mohammad Yusof, 2017). Therefore to assess and to evaluate the effectiveness of IS has been an important research issue since the theories in evaluating IS may vary in their perspectives and contexts. The diversity of these evaluation theories allows different factors to be measured in various contexts. Evaluating IS performance that benefits the organizations could not easily been done because they are usually integrated into an operational process (Zainon & Singh, 2019). ISs are built with multiple functions, integration, and an inter-organizational wide scope; and are used to support strategic applications of the organizations. Based on these reasons it is difficult to evaluate the effectiveness of IS to the organization and to separate it from other performance factors of an organization. According to Erceg et al. (2019), if the organization adopts a quality system then it is able to contribute to the improvement of organizational performance. System is considered has a poor quality if it is not developed according to the specified user specifications (Osita-Ejikeme, 2021). It can be concluded that a quality information system is able to manage information as well as meet the needs of users and organizations (Shim & Jo, 2020). Thus there is a need to prove that there is a significant relationship between system quality and organizational performance. Therefore, a model that is able to evaluate this relationship becomes the purpose of this study.

The View of Developers on System Quality

Study conducted by Ijab et al. (2017) states that quality data could guarantee the quality of a system. System is considered achieved its quality if the data used is able to produce accurate and concise information. Even users are satisfied if the system is quality, able to fulfil their daily works and meet their expectations. Indirectly the organization's desire to improve performance could be achieved with a quality system (Mehrabioun et al., 2022). It can therefore be concluded that there are three dimensions that determine the quality of a system, namely the quality of data (Ijab et al., 2017), user satisfaction (Osita-Ejikeme, 2021) and organizational needs (Pereira et al., 2022). Irony is that until now there is lack of studies that look into these three dimensions when studying the quality of a system. A study conducted by Mehrabioun et al. (2022) did not take into account these three dimensions when studying the quality of the system. For example a study conducted by Mehrabioun et al. (2022), Shim & Jo (2020) and Fong et al. (2018) look at system quality factors from the perspective of users. Views from system developers on system quality are not taken into account. These researchers make an assessment of an information system that is focused on the quality of the information produced and not at the stage of information systems development process (Ijab et al., 2017).

This study emphasizes that the quality of the system is dependent on the systems development process itself. Naturally system developers are more knowledgeable in the process of information generation through system development. The skill and knowledge of the system developers able to determine the quality of the system produced since the development are according to the specification stated by the users and computing standard. These standards

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outline the quality of the system that needs to be achieved when developing a system (Sabeh et al., 2021). Due to technology advancement and new skills in systems development, the views of system developers are also evolving in-line with technological advances. Therefore the study in obtaining the views of system developers in identifying the success of information systems is still relevant and should take into account. Thus, there are two objectives outline in this study. The first objective is to identify the factors that influence information systems quality from the point of view of system developers. The second objective is to develop an evaluation model to measure the quality of Information Systems. Four steps were taken to achieve the objectives of the study, namely:

i. Reviewing the existing Information Systems Evaluation Model on their strengths and weaknesses and suggest further improvements.
ii. Identifying factors and sub-factors that influence quality of the system from existing studies.
iii. Verifying and seek an improvement from the system developer on the factors and sub-factors identified.
iv. Developing an Information Systems Evaluation Model based from the system developer's views and verification.

Reviewing the Existing Information Systems Evaluation Model

System evaluation process that based on its quality is a standard method in assessing the ability of the system meeting the needs of both implicit and explicit elements (Sudirman & Mohammad Yusof, 2017). Proposing IS evaluation has been a critical studies in many research domains. Series of studies have been done in proposing and improving the existing IS evaluation theories. There are common basis and principles of IS evaluation theories that could be referred when developing an evaluation model. Although there are various models in system success evaluation, however this study focuses on four models. These models were selected based on similar objective which is to evaluate system success from the business perspective and system quality aspects. Information Systems Success Model is first introduced by DeLone and McLean (Adebowale, 2017). This model states that the user satisfaction and the intention to use the system are influenced by three quality features which are: information quality, system quality, and service quality. However, this model is developed are based from user's perspective (Xuanzhi & Ahmad, 2019), therefore the focused on evaluating the system might be different. Studies done by many researchers (Xuanzhi & Ahmad, 2019); (Adebowale, 2017); (Yakubu & Dasuki, 2018) discovered various constraints in DeLone and Mclean evaluation model. Thus, this model has been refined and improved by other researchers to be used in other discipline and perspectives.

Gonzales & Wareham (2019) proposed Business System Success Model which is an improvement of DeLone and McLean model. This model evaluates the success of information system from the business perspective. Two ISO standards could be referred when evaluating IS quality (Wan Zainal Abidin & Mansor, 2019). ISO 25010 is an evaluation model that evaluates the system quality and software quality based on procurement, development, maintenance, and software audit and quality assurance. ISO 25012 is another evaluation model created to evaluate the data quality standards of the system. This model is a complement to the ISO 25010 model that evaluates as the degree to which the proposed data properties meet the user needs (Shim & Jo, 2020). This model consists of three parts, which are: i) Inherent Data Quality, ii) System-Dependent Data Quality, and iii) Inherent and System-Dependent Data Quality. However, this model has different focused since it is intended to evaluate the data quality product solely and not evaluating the system quality. System quality is one of the most

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studied dimensions of IS success. It refers in measuring the information processing system itself, basically how well the hardware and the software work together.

The reviews state that the existing models focus on the assessment of system quality from the user's point of view. Views of system quality aspects from system developers are often ignored. A system developer is an individual who is experienced in system development. They are able to ensure the system developed is efficient, effective and meets the needs of the users. Their view in identifying and evaluating the quality aspects of the system needs to be taken into account.

Factors Affecting Information System Quality

Organizations now rely heavily on the use of information systems to implement and optimize their business processes. Quality systems have an impact on the information quality and the quality of services and thus will improve organizational performance (Osita-Ejikeme, 2021). Therefore, the performance of an organization is highly dependent on three main aspects, namely the quality of data available in the system, the satisfaction of users who use the system and the needs of organizations that use the system in daily operations. The following describes the importance of these three factors in determining the quality of the system to improve the performance of the information system.

Data Quality

The quality of a system depends on the quality of the data used. A study conducted by Shim & Jo (2020) states that poor system quality will result in low quality of information for example the system will produce inaccurate or irrelevant data. There are three measurements determine the quality of data, namely the accuracy of the data generated by the system for various processes, the value of the data generated by the system that can be used by the user and the contents of the database information system.

Consumer Satisfaction

Organizations faced two challenges that may affect daily productivity, namely consumer satisfaction and work stress (Mehrabioun et al., 2022). These challenges could be overcome if the organization provides a system that is able to offer satisfaction to the users. According to Gonzales & Wareham (2019), to determine the quality of the system, it should base on the ability of the users to use the system. Features such as user-friendly, easy-to-understand the interface of the systems are something that is seen in evaluating system quality. The satisfaction of the consumer using the system is very important in increasing work productivity. This indirectly has a negative effect if it is not given a special attention.

Organizational Needs

Information systems are a medium that can be used by organizations to launch business operations and in turn are able to provide competitiveness to other organizations (Pereira et al., 2022). The information system should be developed in accordance with the needs and objectives of the organization. Shim & Jo (2020) explained that in studying the factors of organizational needs, the instrument that needs to be focused is the ability of the system in meeting the needs of users when using the system, the level of system reliability, system elasticity and system security. This instrument can be categorized into two aspects, namely user needs and system functionalities.

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Based on the reviews and analyzing the existing IS evaluation models, this study identified three factors that affect the quality system which are data quality, user satisfaction and organizational needs. There exists a relationship states that the system is able to reach its quality if the data used is quality, users are satisfied with the system and the system is able to support organizational needs. These three factors could be considered as system quality features. Therefore these features could be used as a measurement to evaluate the system quality. Views from system developers in identifying the suitability of these factors for evaluation are deemed important.

Items Affecting Data Quality, User Satisfaction and Organizational Needs

While investigating the three factors identified earlier, there are several items that are also influence by these factors. To identify these items, a number of publications are investigated and recent studies have been referred. These studies are selected because they are comparable with the study conducted, where identifying factors and sub-factors that influence system quality have been the main focus. A total of sixteen items have been identified from these studies and classified under three main factors. The classification of these items to the factors is based on the suggestion by the IS domain expert. Four items are classified under Data Quality, six items are classified under User Satisfaction and six items are classified under Organization Needs. Table 1 shows the classification of each item into these three factors.

Table 1: The Classification of Items

Data Quality	User Satisfaction	Organizational Needs
• Data Accuracy • Current Data • Efficiency • System Accuracy	• User friendly • Easy to Learn • Accessibility • User Needs • Response Time • User Interface	• Database Contents • Functional Systems • Flexibility • Reliability • Integration • Security

To identify the most suitable items to represent the three factors (data quality, user satisfaction, and organizational needs) thus, the frequency of each item found in the literatures is recorded. These frequencies will be used as a guide to select the appropriate item for each factor. The items with highest frequency are selected since they are the most common factors appeared in the literature and other items might be considered based on the recommendation by the system developers expert and supported by the literature. Table 2 summarized the findings by stating the source of information from these studies and the number of appearance of each item in each study. Referring to this table, the most suitable items are identified for each factor.

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Table 2: Items Affecting Data Quality, User Satisfaction and Organizational Needs

	Quality Data				User Satisfaction						Organizational Needs					
	Data Accuracy	Current Data	Effectiveness	Data Integration	User Friendly	Easy to Learn	Accessibility	Response Time	User Interface	Reliability	System Functionality	System Accuracy	Flexibility	User Requirement	Security	Database Content
Adebowale, 2017	*	*					*		*	*				*		
Alves et al., 2016	*		*		*	*	*	*	*		*			*		
Cater-Steel & Lepmets, 2014	*						*					*				*
Erceg et al., 2019	*	*	*					*				*				*
Fadhel et al. 2020			*		*					*	*				*	
Fong et al., 2018				*	*	*		*		*	*	*				
Gonzales & Wareham, 2019	*	*		*	*	*	*	*					*	*	*	
Mehrabioun et al. 2022			*	*						*	*				*	
Osita-Ejikeme, 2021	*	*	*	*	*	*	*			*	*	*	*	*		*
Pereira et al., 2022	*	*					*		*	*						
Sheikhtaheri et al., 2014	*			*			*	*					*			
Shim & Jo, 2020			*			*					*					*
Suryanto et al., 2016.					*			*	*		*				*	
Yakubu & Dasuki 2018					*		*		*						*	
Wan Zainal Abidin & Mansor, 2019	*	*		*	*	*		*				*	*	*		
Frequency	9	6	6	6	8	6	8	7	5	6	7	5	4	5	5	4

For the data quality factor: data accuracy is selected since it received the highest frequency. Since the other three items (current data, effectiveness and data integration) received the same frequency, the opinion of the experts is sought. Based on their recommendation current data is selected as item to represent the data quality factors. This recommendation is also supported by the reviews (Osita-Ejikeme, 2021); (Fadhel et al., 2020).

For the user satisfaction factor: two items (user friendly and accessibility) are selected since they received high frequency. Based on experts recommendation, easy to learn and response

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time are selected to represent the user satisfaction and these items are supported by the reviews (Mehrabioun et al., 2022); (Xuanzhi & Ahmad, 2019).

For the organizational needs factor: system functionality is selected as it received the highest frequency. Since the other three items (system accuracy, user requirement and security) received the same frequency, the opinion of the experts is sought. Based on their recommendation user requirement is selected as an item to represent the organizational needs factor. This recommendation is also supported by the literatures (Adebowale, 2017); (Gonzales & Wareham, 2019).

These sixteen items are called the sub-factors to its factor. These sub-factors are explained as follows:

1) Data Accuracy
Data accuracy is a major factor in previous studies that have been discussed previously. Studies conducted by Erceg et al. (2019) and Sheikhtaheri et al. (2014) state that data accuracy factor is important in determining system quality. Data accuracy is also appeared as a guideline in the ISO 25012 International Standard Model for determining system quality.

2) User friendly
According to a study conducted by Alves et al. (2016), user-friendly is a factor that can be used in measuring the quality of the system. It is also one of the factors that have been outlined in the ISO 25010 International Standard Model.

3) Accessibility
Based on the ISO 25012 International Standard Model, accessibility is a guideline that should be considered in measuring system quality. A study done by Gonzales & Wareham (2019) states that easy to access the functions in obtaining information are the characteristics of a quality system.

4) Response Time
Response time in using information systems is important in measuring the performance of information systems in order to establish trust in using the system. It has also been outlined in the ISO 25010 International Standard Model.

There are four sub-factors that are not significant based on the findings of the library study. However, these sub-factors are considered important and can be used as complements in reviewing items influencing the quality of information systems and these sub-factors are recommended by the experts to be included in evaluating IS systems. The descriptions of the sub-factors are as follows:

1) Current data
The current data are selected because some studies outlined the current data are the key in measuring system performance. It can be seen in the study of Alves et al. (2016) and Ijab et al. (2017). The current data is also stated in a guideline in the ISO 25012 International Standard Model as part of system quality features.

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2) Easy to Learn

In a study done by Alves (2016) and Wan Zainal Abidin & Mansor (2019) stated that the level of ease of learning of a system can affect the quality of information systems. This item appears as one of the guidelines found in the ISO 25012 International Standard Model. It can be used to measure user understanding of the information generated by the system.

3) System Functions

According to International Standard Model 25010, this item is suitable to be used in assessing the system's ability to meet organizational objectives. It has been used in several studies such as Gonzales & Wareham (2019) and Mehrabioun et al. (2022).

4) User Requirements

Alves et al. (2016) stated that user requirements are the factors needed to ensure the quality of information systems. This factor is outlined in the ISO 25010 International Standard Model, which can be used to assess the system's ability in meeting user needs. This sub-factor is placed under the appropriate main factor according to previous studies.

Based on the understanding of these three factors and eight sub-factors, a conceptual model is proposed to show the relationship among these factors and the sub-factors. This model is built based on the modification of IS Success Model theories (Sabeh et al., 2021). This study explores and expands the implication of system quality in improving the organization performance. Since system developers are the knowledgeable person in developing the system, therefore their view in identifying system quality has been the focused of this study. Their views in identifying system quality are different when compared with the view from the users. This is the main reason the information quality and service quality factors as appeared in IS Success Model are not considered and it is beyond the boundary of this study. Figure 1 shows the proposed conceptual model that indicates the relationship among five main factors in evaluating the quality of information systems.

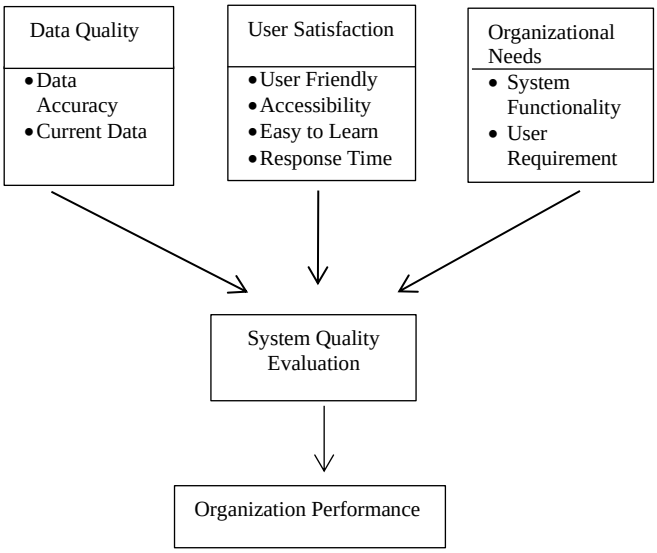

Figure 1: The Proposed IS Evaluation Model

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Research Findings

To develop a quality information system, it should start with a proper system development and good data processing methods. Only staffs with experiences in system development such as information technology managers, system analysts, programmers, database administrators and technicians can determine whether a correct method employs in system development. Ironically in previous studies, system developers' views are often overlooked in determining system quality. Previous studies have focused more on the views of users, where the views of users and system developers are different in evaluating the quality factor of a system. Users evaluate the quality of the system only based on the usability of the system in performing their daily activities. While the evaluation of system quality from the point of view of the system developers are based on the ability of the system to meet the needs and specifications of the system outlined and the extent to which the system is able to improve organizational performance. In this study the system development group has been entrusted in determining the factors that influence the quality of the system. They agree that three factors namely data quality, user satisfaction and organizational needs are factors that influence the quality of the system. Organizational need factor is to ensure the data used by the system must be of good quality. The system used by the organization must be able to meet the satisfaction of users who use the system. Also, the system must be able to meet the needs of the organization in conducting day-to-day business operations. If the organization is able to implement these three factors then the performance of the organization will be able to improve. Based on the developers experience in developing a quality system, guidelines or tips on the system development based on the identified factors are outlined. This guideline could be used by the system development teams in producing quality systems. Table 3 lists this guideline.

Table 3: A Guideline in Producing Quality System

Data Quality	
Data Accuracy	• Need to identify source of data • Monitor data movement • Generates error message automatically
Current Data	• Establish a proper data duplication function • Carry out additional analysis when system or data functions are updated • Data cleaning
User Satisfaction	
User Friendly	• Provide a structured interface • Simple interface • Functional information system
Accessibility	• Improving hardware technology in organizations • Ensure all navigation systems work properly
Easy to Learn	• Develop a consistent information system • Divide the category of functions clearly • Provide user manual
Response Time	• Keep the data in the correct table • Keep the data in array form
Organizational Needs	
System Functionality	• Clearly identify the objectives on the usage of information systems in the organization

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	• Provide simple system maintenance function
User Requirement	• Provide system usage training • Build a system that achieves organizational objectives

Conclusion

The literature states that the organization is very dependent on the information system in carrying out daily activities in the organization. Every organization needs to evaluate the information system used so that its usage is always at the optimum level. This leads to various studies conducted in evaluating and producing a quality information system. Factors and sub-factors influencing the quality of the system identified in this study are expected to provide guidance to the organization to produce a better quality system and in turn can improve organizational performance. As discussed, the views of system developers in determining system quality factors are important in developing systems that are capable of improving organizational performance. From the literature, the views from system developers are often ignore when identifying system quality factors. In future, the view of systems developers in other aspects of quality such as information quality and service quality will be explored. It is our hoped that the findings from this study are able to add value to the organization investments as well as to increase the rate of success for costly system development initiatives.

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