

# STUDY OF DELONE-MCLEAN INFORMATION SYSTEM SUCCESS MODEL: THE RELATIONSHIP BETWEEN SYSTEM QUALITY AND INFORMATION QUALITY

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## ABSTRACT

Information has become a strategic need for the future success of the organization. All organizations need information to make effective decisions. Information is an output of information system (IS). Consequently, the quality of information depends on the IS implementation. The purpose of this study is to evaluate the IS success model. A survey approach was used in this study. The populations were Muhammadiyah higher education institutions and simple random sampling for determined respondent. PLS-SEM was used as an analytical tool. The data were collected using a questionnaire. This study models the relationship between IS quality and information quality. We hypothesize that higher quality information is generated from high-quality systems. The results have shown that IS quality affected information quality. The use of high quality IS can produce high-quality information. Therefore, to improve the quality of information, an organization needs to improve IS quality. To make it can be done through increased some dimensions, such as integration, flexibility, ease of use and accessibility. Thus, the information quality can be measured by the relevant, accurate, timely, and complete information. Later, the quality of information has been influenced by the IS quality. This study contributes theoretically to IS success models through the link of system quality to information quality.

**Keywords:** *Information System Success Model, Information Quality, System Quality, Flexibility, Ease of Use*

## 1. INTRODUCTION

Every organization needs accurate, relevant and timely information as a basis for decision making [1]. Strategic information is needed for the long-term life of the organization (going concern). Information is generated from the use of information systems (IS). IS implementation should be able to provide useful and valuable information to users. Information can reduce uncertainty and control activities. This can help in achieving organizational goals. Chong stated that information can help managers understand their tasks more clearly and reduce uncertainty before making a decision [2]. In the IS concept, all elements (hardware, software, people, procedures, databases and communication networks) and sub-systems that make up the IS must be integrated to produce qualified information [3].

The implementation of IS requires more careful attention because of the high failure rates [4]. Uwadia et al. reported that 25% of IS implementation projects are failed, 60% of IS implementation costs exceeded their budget, 75% have a quality problems [5]. Cabrera et al. argued that around 80% - 90% of IS projects failed to meet user performance targets [6].

Previous studies about the success model of IS have been carried out [7-12]. DeLone and McLean identified six components of the success of interdependent IS, such as system quality, information quality, use/intention of use, user satisfaction, individual impact, and organizational impact [7]. Then, they updated their model (Updated D&M IS Success Model) by adding service quality components and replacing individual impact components and organizational impacts with net benefits [8].

This study used two components, there are system quality, and information quality. DeLone and McLean stated that information quality is the IS output used. But in this model, system quality and information quality are not linked. Both become independent variables that affect use/intention of use and user satisfaction. [7][8].

This study tried to determine the relationship between the two variables. As Raymond and Bergeron, Gorla et al., Sacer and Oluic, and Al-Mamary et al. stated that information quality depends on system quality because the information is the output of the system [13-16]. Other research results also showed that the design and implementation of effective IS will increase the accuracy of the information produced [17-19].

## 2. LITERATURE REVIEW

### 2.1 Information System Quality

According to Susanto, a high quality of IS is a system that is effective and can be used to improve control, efficiency, and speed for system users [3]. Gable et al. measured the system quality for IS from a technical and design point of view [20]. Thus, perceptions of system quality can be defined as user evaluations of IS from a technical and design perspective. Romney and Steinbart explained the elements of IS's success are usefulness, economy, reliability, availability, timeliness, customer service, capacity, ease of use, flexibility, tractability, auditability, and security [21]. Heidman explained the IS measurement through integration, flexibility, accessibility, formalization and media richness [22]. Whereas Petter et al. argued the characteristics of IS quality include: ease of use, system flexibility, system reliability, and ease of learning, as well as system features which are intuitive, sophistication, and response time [23].

Previously, Bailey and Pearson used convenience of access, flexibility, system integration, and response time in measuring system quality [24]. While, Seddon used reliability, user interface consistency, ease of use, quality documentation and maintenance of program code [25]. Lee et al. explained that the quality of web-based systems is measured by the convenience of access, flexibility, integration, response time, sophistication, reliability, accessibility, stability, system speed, usability, ease of use, navigation and network speed [26]. Nelson et al. used reliability, flexibility, accessibility, integration, and response time as indicators of system quality [28].

The quality of IS is an important driving factor for people to use and get benefit from the system [25][27]. The quality of the system represents the quality of IS processing itself, which is a measure of the system quality technically. It were measured by attributes including ease of use, functionality, reliability, data quality, flexibility, and integration [7]. System quality measurement continues to be developed by DeLone and McLean, including ease of learning, ease of use, availability, response time, system reliability, flexibility, personalizability, system interactivity, and system security [8].

### 2.2 Accounting Information Quality

Information is data that has been arranged and processed to provide meaning and help in the decision making the process [21]. Users need quality information which has the characteristics and attributes of information that is beneficial to them. The quality of information is directly related to how information can be used in decision making to achieve organizational goals.

Information quality refers to the quality of output produced by IS [7]. The indicators of information quality are accuracy, timeliness, completeness, relevance, and consistency [8]. Nelson et al. use indicators of accuracy, completeness, currency, and format for information quality [28]. Thus, Rai et al. use content indicators, accuracy, and format as a measure of information quality [27].

According to Romney and Steinbart, characteristics of useful information are relevance, reliability, completeness, timeliness, understandability, and verifiability [21]. Whereas according to Gelinas and Dull, qualities of information are effectiveness, efficiency, confidentiality, integrity, availability, compliance, reliability [29]. Hall stated that useful information has the following characteristics which are relevance, timeliness, accuracy, completeness, and summarization [30].

Other characteristics of quality information are relevance, accuracy, timely, and complete [31]. According to Petter et al. desired characteristics of a system's output including relevance, comprehensiveness, accuracy, conciseness, completeness, currency, timeliness and usability [12]. Gorla et al. explained that information quality indicators including information content (accurate, complete, concise, useful, and relevant) and

information format (format, consistency, and easy to understand) [14].

### 2.3 The Effect of Information Systems Quality on Information Quality

System quality is a representation of information processing quality itself. IS quality is characterized by the use of advanced technology, systems that offer key functions and features, and software that is user-friendly, easy to learn, and easy to maintain [14]. The success of IS implementation can be seen from the information generated. The information will be useful for business people, relevant for decision making, and easy to understand. The failed IS implementations are usually prone to errors and have no system security [32]. It produced irrelevant, inaccurate and incomplete information.

Salehi et al. showed that high-quality IS will improve the accuracy of the information produced [17]. It means, the organizations that have a high quality IS has more precised information and reported accurately. The same conclusion was stated by Salehi and Torabi, that high quality IS increase the relevance and reliability of information [18]. Likewise, Alzoubi concludes that integrated IS increased the relevance of information and reduced the level of uncertainty in making decisions [33]. Integrated IS provided relevant, timely, complete and accurate accounting information. Sambasivam and Assefa also concluded that the design and implementation of

effective IS can improve the quality of information [19]. According to Fitriati and Mulyani, the success of IS were reflected in the high level of employee confidence for the usefulness and ease of use. It have increased its use. The IS effectivity have became important role on collecting, processing, classifying and reporting financial transactions for recording, attention find and make decisions by end-users of the information. The IS were implemented effectively could produce the quality information, like as relevant information, accurate, timely, and complete [34][35].

### 3. METHODOLOGY

The research design uses a survey approach based on quantitative measurements. The type of data used is primary data, with a questionnaire research instrument. The population of this study were Muhammadiyah higher education institutions in Indonesia. Probability sampling was used with a simple random sampling technique. Respondents in this study were the head and staff of the finance department who used the financial information system.

The variables in this study are IS quality and information quality. Both of these variables are latent variables. The operational definitions of variables are presented in Table 1. The analytical tool used is Structural Equation Modeling (SEM) based on component or variance using Partial Least Square (PLS).

Table 1: The Operational Definitions of Research Variables

Variables	Dimensions	Indicators
IS Quality [20][24][36] [37][38][39]	Integration [20][24][36][37]	Level of IS components integration
		Level of sub-system integration
	Flexibility [20][24][36][37]	A system can adapt to changing conditions
		A system can adapt to a variety of user needs
	Ease of Use [20][37][38]	Ease of learning
		Ease to use
Accessibility [20][39]	A system can be accessed with relatively low effort	
	A system can be accessed from anywhere	
Information Quality [20][24][36] [37][38][39]	Relevance [20][37][39]	User should be able to select the data that are needed
		The information has relevancy when it pertains to the problem at hand
	Accurate [20][24][36]	The correspondence between the information and the actual events that the information represents
		Free error or bias
	Timeliness [20][24][36] [38][39]	Provided in time for decision-makers to make decisions
		Users should be able to obtain information that describes what is happening now
	Completeness [24][36]	All the necessary data are available
		Users should be able to specify the amount of detail that needed

PLS-SEM analysis consisted of measurement or outer model and structural or inner model. The measurement model in this study has two stages. The first order is a dimension measurement model

of the indicators. The second order is a measurement model of the latent variables to its dimensions. The measurement model for IS quality and information quality is presented in Figure 1.

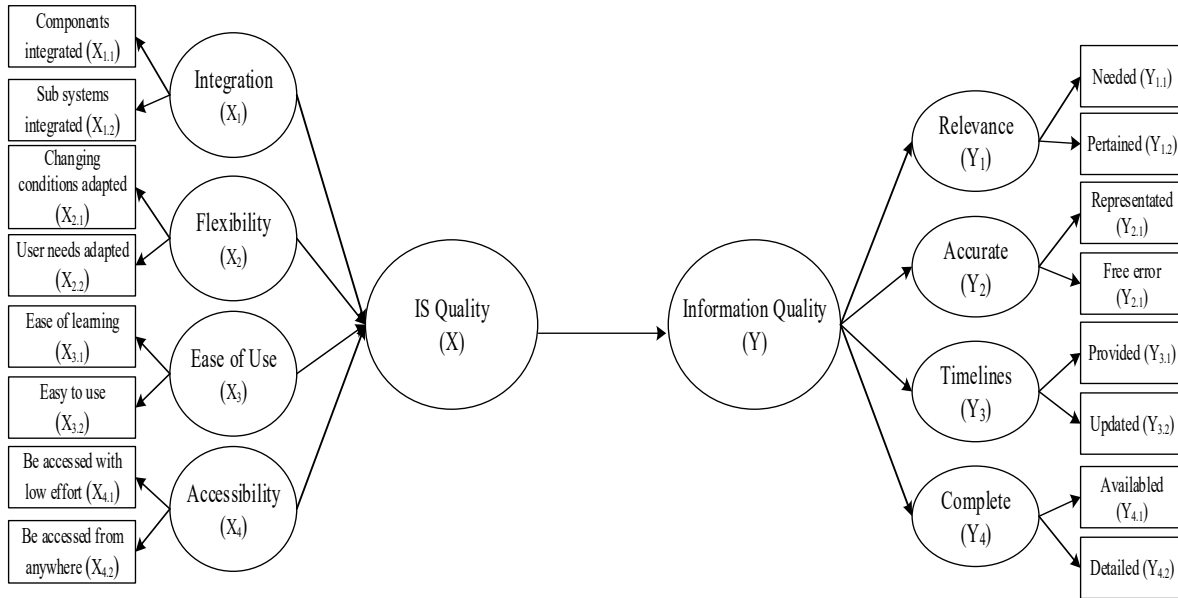


Figure 1: IS Success Model

4. RESULT AND DISCUSSION

The number of respondents in this study was 287 people. Characteristics of research respondents as

in Table 2. The descriptive statistics of variables, dimensions, and indicators used in this study are presented in Table 3.

Table 2. Characteristics of Research Respondents

No.	Characteristics	%
1.	<b>Gender</b>	
	Male	40.4%
	Female	59.6%
2.	<b>Age</b>	
	≤ 30 Years	26.4%
	31 – 40 Years	32.7%
	41 – 50 Years	29.8%
	≥ 51 Years	11.1%
3.	<b>Education</b>	
	High School	6.3%
	Diploma	13.2%
	Bachelor	57.1%
	Master	23.4%
4.	<b>IS Software</b>	
	Made by own	25.0%
	Made with another	60.4%
	Made by another	14.6%

Table 3. Descriptive Statistics of Research Variables

Variables	Mean	Dimensions	Mean	Indicators	Mean
IS Quality	3.05	Integration	2.91	X <sub>1,1</sub>	2.99
				X <sub>1,2</sub>	2.83
		Flexibility	3.02	X <sub>2,1</sub>	2.85
				X <sub>2,2</sub>	3.19
		Ease of Use	3.49	X <sub>3,1</sub>	3.47
				X <sub>3,2</sub>	3.51
		Accessibility	2.77	X <sub>4,1</sub>	3.18
				X <sub>4,2</sub>	2.36
Information Quality	3.49	Relevant	3.28	Y <sub>1,1</sub>	3.26
				Y <sub>1,2</sub>	3.29
		Accurate	3.48	Y <sub>2,1</sub>	3.49
				Y <sub>2,2</sub>	3.48
		Timelines	3.64	Y <sub>3,1</sub>	3.73
				Y <sub>3,2</sub>	3.56
		Complete	3.55	Y <sub>4,1</sub>	3.65
				Y <sub>4,2</sub>	3.45

The IS quality measurement model and the quality of accounting information consist of two stages. The first stage showed the relationship of

dimensions to the indicators and the second stage shows the relationship of latent variables to their dimensions. The results of the measurement models are presented in Table 4.

Table 4. Loading Factor, R<sup>2</sup>, AVE, CR

Dimensions	Indicators	Loading Factor	R <sup>2</sup>	AVE	CR
Integration	X <sub>1,1</sub>	0.93	0.86	0.87	0.93
	X <sub>1,2</sub>	0.94	0.88		
Flexibility	X <sub>2,1</sub>	0.87	0.77	0.79	0.88
	X <sub>2,2</sub>	0.91	0.81		
Ease of Use	X <sub>3,1</sub>	0.96	0.92	0.92	0.96
	X <sub>3,2</sub>	0.86	0.921		
Accessibility	X <sub>4,1</sub>	0.74	0.78	0.60	0.74
	X <sub>4,2</sub>	0.76	0.54		
Relevant	Y <sub>1,1</sub>	0.94	0.89	0.89	0.94
	Y <sub>1,2</sub>	0.95	0.89		
Accurate	Y <sub>2,1</sub>	0.90	0.82	0.81	0.89
	Y <sub>2,2</sub>	0.90	0.79		
Timelines	Y <sub>3,1</sub>	0.94	0.88	0.88	0.94
	Y <sub>3,2</sub>	0.93	0.87		
Complete	Y <sub>4,1</sub>	0.83	0.87	0.87	0.93
	Y <sub>4,2</sub>	0.74	0.87		

Table 4 indicated all of indicators were valid measured their dimensions. The indicator reliability test in this study used the value of R<sup>2</sup>. The results of the indicator test showed that all of the indicators have an R<sup>2</sup> value of 0.5 or more. It showed that all indicators meet reliable criteria [40]. Furthermore, the AVE value of all dimensions is more than 0.5, so that it can be said that all indicators have good convergence validity. The reliability test used Composite Reliability (CR) value which showed that all dimensions have values greater than 0.7,

meaning that all indicators in each dimension have good internal consistency [41].

Table 4 shown the model have met the criteria of a model fit. It means the measurement models of IS quality and information quality were good. These proved that all indicators used in this study have reflected their dimensions were valid and reliable. Likewise, dimensions can also explained the latent variables.

Validity and reliability test results (Table 4) showed that all indicators used are valid and reliable. All indicators used can reflect the constructed variable. It means that system quality can be measured using these indicators, which are integration [8][22][24], flexibility [8][24][26], ease of use [8][21][25][26] and accessibility [22][24][26]. While information quality can be measured using these accurate indicators [8][28][30], relevant

[8][21][30], timeliness [8][21][30] and complete [8][21][28][30].

Evaluation of the structural model according to Hair et al. including testing the significance of path coefficients (t-statistics and p-values), R<sup>2</sup> (coefficient of determination) and f<sup>2</sup> [41]. The structural model in this study involved exogenous latent variable (IS quality) and endogenous variable (information quality). The test results are presented in Figure 2 and Table 5.

Table 5. Path Coefficient, p-value, R<sup>2</sup> and f<sup>2</sup>

Variables		Path coefficient	p-value	R <sup>2</sup>	f <sup>2</sup>
Exogenous	Endogenous				
IS Quality	Information Quality	0.68	0.00	0.46	
Integration	IS Quality	0.33	0.00		0.21
Flexibility	IS Quality	0.28	0.00		0.16
Ease of Use	IS Quality	0.31	0.00		0.17
Accessibility	IS Quality	0.29	0.00		0.19

Many Muhammadiyah higher education institution developed IS. It was used to produce information that is useful for the development and productivity of their organizations. Table 3 shows that IS is not effective both from the dimensions of integration, flexibility, ease of use and accessibility.

Atiyah found that implementation was often constrained by technical, organizational, and human problems [42]. IS quality can be managed and maintained only if the quality of all its components (people, technology and other equipment) can be maintained [15].

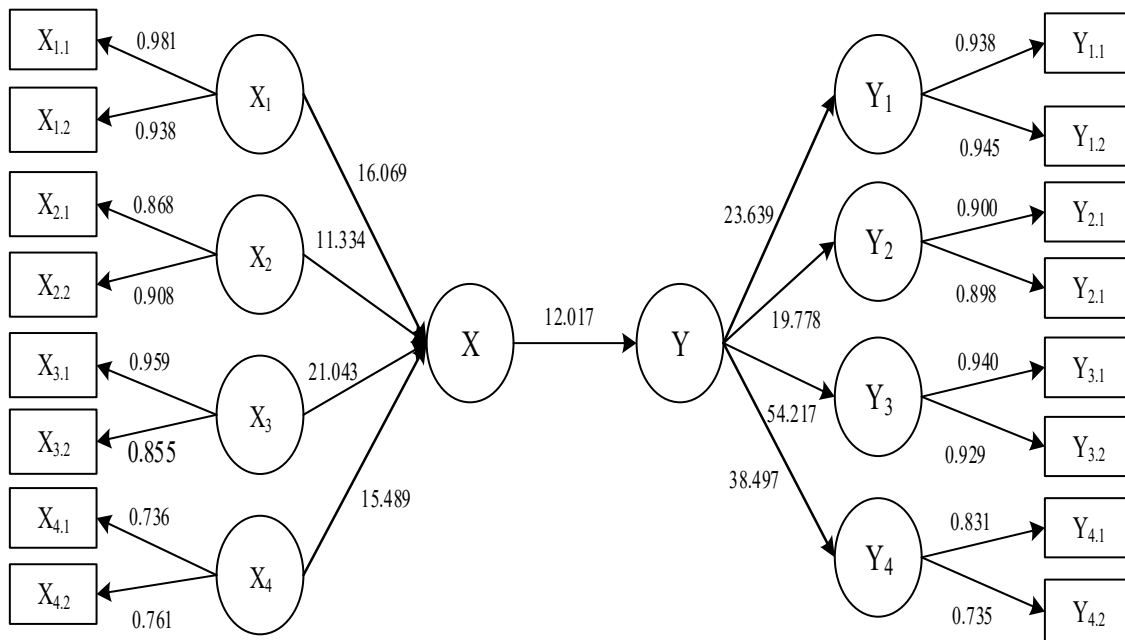


Figure 2: Test Results of Measurement and Structural Models

Table 2 shows that the majority of respondents were female (59.6%). This condition indicated it can affect the effectiveness of IS. When using IS,

women have a harder effort than men. Men are more adapted to using it than women [43]. This is because they have more anxious when using technology [44]. Women faced technical obstacles



in understanding of it [45]. Jackson et al. stated that women are more susceptible to anxiety, less effective and have an attitude that is not good at using it [46]. According to Venkatesh and Morris, there are differences in men and women related to the perception and IS level of use [44]. For men, the decision to use it was strongly influenced by their perception of the usefulness of technology, while women are stronger influenced by the ease of use perceptions [47].

The ineffectiveness of IS implementation hasn't caused by the user's education level. In Table 2, it is also known that respondents with a higher education level (bachelor and master's degree) were as much as 80.5%. According to Burton-Jones and Hubona, Mathieson et al, education hasn't only increases someone's knowledge and skills but also provides other benefits (such as problem-solving skills), which in turn increases a user's ability to overcome IS problems and thus makes IS more successful [48] [49]. The user's education level didn't produce a consistent effect on IS use [23].

From the results of the studies, it is also known that IS quality affects the quality of information at a significance level of  $\alpha = 5\%$  (Table 5). It explained that were through the higher IS quality, would produce higher information quality. It means to improve the quality of information, an organization must improve IS quality. Respondents' response to the integrated dimension of IS quality showed that all IS components (such as hardware, software, brainware, databases, internet networks, and procedures) were used haven't been fully integrated harmoniously.

In the implementation of IS at several institutions, they experienced technical obstacles such as computers that had to take turns with other employees or they needed to bring personal computers. Besides that, there are 41.5% of the implementation of it often experience hang, slow down, freeze, unresponsive programs, failure, etc. This showed that the function of hardware, software, databases, internet networks not yet fully by the needs of the information system so that the integration between components cannot be optimized.

IS functions/subsystems are not integrated harmoniously. This is indicated by the inability of users to access information from other functions/parts through IS. In most institutions to obtain information needed, users still have to request manual reports from other departments. According to Sori, integration in the

implementation of IS can accelerate the process of providing information and overcoming the weaknesses of manual systems [50]. The quality of IS improved organizational capabilities in terms of accuracy, ease of use, reliability, timeliness, content, format, and satisfaction to improve management performance and information quality [51].

IS flexibility was used not optimal. It was indicated by the software that used hasn't provided facilities/features that provide choices/alternative changes. The software can't optimally adjust whenever there is a change in the environment or changes in business strategy. There 74.5% designs of IS software were used involved other parties outside the institution. The problem was faced when there are changes in the environment and/or in business needs/strategies, the information needed also changes and cannot be provided by IS. With these changes, some of them must be made IS (software) replacements.

The flexibility of IS related to business changes to maintain strategic alignment in today's business environment [52]. Previous studies have shown that flexibility in IS is an influencing aspect in maintaining strategic alignment [53][54]. Concerning ease of use, most institutions have provided easy to understand IS implementation procedures and facilities/features that are easy to operate. The ease of use of IS becomes constrained when there is a software replacement or position rotation. Users need to relearn the operation of new software. They need time to have experience and expertise. Likewise, with new employees, it takes longer to use IS. This resulted in information that cannot be immediately generated or becomes late and incomplete.

IS accessibility has the lowest average score. Users can access IS on campus but most users say it is not easy. Even 19.1% of users cannot access outside their campus. IS have used LAN/Wi-fi as a network connection but the software used is not website based. This cause IS were not easily accessed. Therefore, the information produced is not timely. The use of online media can improve information accessibility [55][56]. Organizations can obtain information directly and easily through online media. The low quality of IS (seen from the dimensions of integration, flexibility, ease of use and accessibility) causes the information that it produces to be poor also.

This results implied if the institutions need the availability of high-quality information (ie

information that is easily understood, consistent, complete, accurate, relevant to decision making), then IS effectiveness is needed. This can be done by providing sophisticated IS (such as modern technology, easy to use, and integrated all subsystems). IS facilitates the availability of information in enabling a performance valuation systems for continuous improvement.

The results of this study are in line with Gorla et al which showed that there is a positive relationship between system and information quality [14]. The failure of IS produced the poor information output. It caused competitive disadvantages because of its inability to provide high-quality information, especially in terms of content and format. The use of modern technology, formal development methods, and appropriate system features for users will facilitate the improvement of information quality. Improvement in system quality can help to provide easily understood information output and timely reports, and changing information needs can be met quickly.

Sajady et al. also concluded that effective IS can improve the quality of information [58]. Effective IS will increase the accuracy of the information produced [17]. Integrated IS will produce relevant information so that it can reduce the level of uncertainty in decision making [33]. Furthermore, Sacer and Oluic state that information is the output of an information system [15]. As a result, the quality of information depends on the quality of the IS. The quality IS can produce quality information too, which is reliable, accurate and timely [29]. If it is not qualified, one of the risks that might occur is the existence of information mismatches at the lower, middle and upper-level management. The next risk is the disharmony of decisions and activities in various departments of the organization, which in turn leads to ineffective, inefficient and uncontrolled organizational performance [3]. According to Gabriel and Obara, effective IS can produce information that is timely and accurate and has implications for efficiency and effectiveness in the organization [58].

## 5. CONCLUSION

This research result could contributed in the management practically. It succeeded in proving that IS quality influences information quality. The use of high quality IS can produce high-quality information. Therefore, to improve the quality of information, an organization needs to improve IS quality. It can be done through increased some

dimensions, which are integration, flexibility, ease of use and accessibility. Information quality can be demonstrated through relevant, accurate, timely and complete information.

The results of this study supported previous research which stated IS that is designed and implemented can improve the accuracy of information effectively [17-19]. Quality IS produced information that suits user needs [59]. IS quality needs to be considered to improve the quality of information produced [13-16].

This study implies that it can be one of the reference in the knowledge development about IS. This research succeeded in developing a model of measuring IS quality and information quality. Indicators that can be used to measure IS quality such as integration, flexibility, ease of use and accessibility [7-8, 22-26, 28]. While information quality indicators include relevant, accurate, timely and complete [7, 12, 14, 27-31]. There was also found a relationship between the quality of IS and the quality of information produced [13-19,59].

The results of this study can be a reference for other researchers regarding the measurement of IS quality and information quality. The IS quality indicators including integration, flexibility, ease of use and accessibility. There also found a relationship on how the effect of IS quality affects the quality of information produced.

The results fulfilled the characteristics of scientific research, so that research can be conducted again using the same research methods in different units of analysis, by adding other research instruments, such as observation and in-depth interviews. Future studies also can be developed by examining key success factors for IS quality, such as; top management support, business processes, user competencies, commitment to the organization and others.

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