

Designing Academic Information System Performance Measurement using Performance Prism and ISO/IEC 25010

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Abstract: Higher education institutions currently have invested heavily in Information Technology (IT). Information systems supported by IT can improve service quality and add value to tertiary institutions. Academic services are the main business processes in higher education. An effective Academic Information System (AIS) can support an effective academic service system. To find out and assess the extent to which the performance of AISs in carrying out its objectives and optimizing IT investment needs to be evaluated system performance. This performance evaluation is done by measuring system performance so that it can make improvements to the quality of the system. Measurement of information system performance is carried out on the quality of the system it self. Performance measurement also involves all stakeholders. The objective of this study is to design performance measurements of AISs. The results of this study are a design of AIS performance measurement using the performance prism method in terms of stakeholders and ISO/IEC 25010 in terms of system quality.

1 INTRODUCTION

In the world of education, where the core of the business process is academic activities, the information system service is essential to support transactional activities, such as facilitating course registration, recording student achievements, etc. (LPTSI, 2016). Transactional activities, as mentioned previously, have been accommodated in an Academic Information System (AIS). An AIS is a system that provides information services related to academic data (Setiyawan et al., 2013). (Sprague Jr and Carlson, 1982) States that AISs are more a series of systems and activities in an organization that uses information as its source to regulate and process. This system provides output in the form of information to leaders or decision-makers with different uses and goals (Levin and Kirkpatrick, 1971).

Poltekkes Kemenkes Surabaya has built an AIS starting in 2011. This system was built to facilitate the academic section in processing academic data and conducting academic services. For students, AISs can make it easier to obtain information about academics. In its development, the AIS has changed from time to time following the user's wishes. After experiencing many changes, there are still some problems such as some menus still have errors, or there are still menus

that are not yet as requested. Given these problems need to be evaluated system performance.

Performance evaluation is carried out to assess the extent to which information system performance increases effectiveness and efficiency in achieving the institutional strategic goals so that steps can be taken to improve or innovate the latest technology and help maximize investment in Information Technology (IT) (Al Agani et al., 2018). The main objective of the information system evaluation function is the improvement in quality (Lagsten, 2011).

The Poltekkes Kemenkes Surabaya has evaluated the system, but it is still manual so that AIS's performance no exact value is obtained. System evaluation is needed in the form of AIS performance measurement. Information systems need to be measured in terms of product quality and service quality, especially in the "capability" function of the information system itself (Govindaraju,). Also, the views of stakeholders about the ability of information system functions can affect the willingness of these stakeholders to propose IT innovation (Zhu, 2004) (Ravichandran et al., 2005).

The purpose of this study is to design a performance measurement system for academic information using the Performance Prism method from the stakeholder side and ISO/IEC 25010 in terms of system

quality.

2 LITERATURE REVIEW

Performance Prism is a performance measurement model developed by (Neely et al., 2002) and is stakeholder-oriented. Performance Prism has important and special features (Neely et al., 2001). Performance prism has five aspects, the top and bottom are stakeholder satisfaction and stakeholder contributions. Whereas the next three sides are strategy, process, and capability (Neely et al., 2001). The objective of this research is to design performance measurements of AISs.

Performance Prism has several advantages in measuring performance including identifying stakeholders from many interested parties, such as owners and investors, suppliers, customers, workers, government and surrounding communities. ISO/IEC 25010 is an international standard in software testing. The ISO/IEC 25010 standard was developed to replace ISO 9126 based on the development of Information and Communication Technology (ICT) (BS ISO/IEC 25010:2011, 2011). The ISO 9126-1 method can be used and adopted for testing various software qualities but needs to adjust to the conditions of the software to be tested.

Using Performance Prism in higher institutions is very good (Smulowitz, 2015) because higher institutions have different system characteristics. Performance prism can evaluate all the 'wants and needs' of stakeholders who might be ignored. Whereas the 'wants and needs' of stakeholders can be the key to the success of higher education in planning for sustainability.

In research (Jun, 2011) using performance prism to measure ERP software. (Jun, 2011) mentions that performance prism is a beneficial performance measurement model in providing management services because it is comprehensive and easy to understand, besides it is not only stakeholder oriented, but performance prism also measures the contribution made by stakeholders to the organization.

(Yu and Zhu, 2011) in his research stated that the evaluation system using performance prism has good practical operability because it uses all stakeholders and their five facets, namely stakeholder needs, organizational strategy, business processes and stakeholder contributions as a consideration.

(Kara, Lamouchi and Ramdane-Cherif, 2017) using ISO 25010 and the concept of fuzzy logic to evaluate the Ambient Assisted Living System, the evaluation results can show the required quality models

and produce quality indicators that can help users in making the right decision at the same time.

(Huda, 2017) in his research, trying to integrate Webqual 4.0 with ISO/IEC 25010. Measurement of academic and financial information systems produces more complete indicators so that the assessment of software quality is better.

Research (Lesmidayarti et al., 2017) uses ISO / IEC 25010 to measure the performance of academic information systems and compares with academic information system measurements using ISO / IEC 9162. The results of measurements using ISO / IEC 25010 are more accurate because of the characteristics of ISO / IEC 25010 more complete.

3 METHODOLOGY

This research was carried out in several stages which are depicted in Figure 1 as follows :

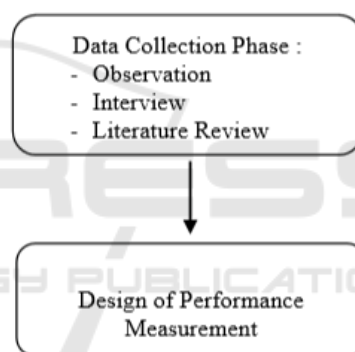


Figure 1: Research Stages

3.1 Data Collection Phase

Data collection techniques are the most strategic step in research because the primary purpose of the research is to get data. Data collection can be done in variety ways, various sources, and various setting (Sugiyono, 2011). The following data collection methods are used:

3.1.1 Observation

Observation is one of the essential tools to collect data. Observing means paying attention to phenomena in the field through the five senses of the researcher, often with instruments or devices, and recording them for scientific purposes. These observations are based on research objectives and research questions (John et al., 2009). This observation was

carried out by looking directly at the processes and activities that are running in the case study of Poltekkes Kemenkes Surabaya.

This technique is done to get a real picture of an event and learn what activities are carried out in the Academic Subdivision of Poltekkes Kemenkes Surabaya.

3.1.2 Interview

Interviews are used as data collection techniques if the researcher wants to conduct a preliminary study to find problems that must be investigated, but also if the researcher wants to know things from the respondents in more depth (Sugiyono, 2011). In this study, interview techniques in the form of personal interviews (personal interviews), personal interviews conducted by doing face-to-face with respondents. This interview method is conducted to find information related to academic activities or activities carried out by the Poltekkes Kemenkes Surabaya by interacting with the Academic Subdivision and IT Unit. From the results of this interview, data, and information in the form of using AIS and AIS changes were collected.

3.1.3 Literature Review

This literature review is carried out to collect and compare the results of several similar studies, such as previous studies regarding the design of measurements with the performance prism and ISO / IEC 25020 methods, then study them. Comparing the results of previous studies also helps the author to find things that distinguish between the author's research with previous studies.

3.2 Design of Performance Measurement

For the design of performance measurements using Performance Prism and ISO / IEC 25010. In this modeling starts from applying the performance prism method. Conducting interviews with stakeholders on each performance prism facet. Then map it to ISO / IEC 25010. Furthermore, do performance calculations.

4 RESULT AND DISCUSSION

In this research, several stages will be carried out in measuring the performance of the AIS Poltekkes Kemenkes Surabaya, among others:

4.1 Problem Identification

Identify the problem to describe what is experienced by IT decision-makers based on their experiences (John et al., 2009). At this stage, several processes are carried out, namely: i). Analysis of case studies, and ii). Literature study

4.1.1 Case Study Analysis

The selection of the Poltekkes Kemenkes Surabaya AIS as a case study due to several considerations include:

1. AISs have been developed starting in 2011 and always developing from year to year
2. An AIS is needed by the academic community and has provided many benefits for its users
3. AISs continue to change following the wishes of users, which means AISs adjust the wants and needs of users. By following the principle of performance prism that prioritizes the needs of users/stakeholders
4. AISs have tried to follow the desires of the user, but until now there are still some menus that are not yet according to the user's wishes

4.1.2 Literature Study

A literature study is done by collecting supporting data about theories that support research, related research, and methods that are widely used as a reference in this research. A literature study is done by examining books, literature, notes, and reports that are related to performance measurement using performance prism and ISO / IEC 25010.

4.2 Development of Performance Measurement Models

According to (Logsdon and Lewellyn, 2000) the application of standards is essential because standardization can create conditions and pressures among stakeholders so as to improve sufficient quality. From a stakeholder perspective, an vital element of the quality of the corporate governance structure is the capacity to protect the interests of various stakeholders (Gnan et al., 2013). Although involving stakeholders is complex and timeconsuming, the benefits are more significant because by involving stakeholders the risk of losing specific information is smaller (Delnoij et al., 2010). Stakeholder analysis must be used as one important evaluation (Farbey et al., 1999),

and understanding stakeholder strategies are beneficial and can affect the success of information systems (Vaidya et al., 2011).

Because quality is the elements contained in a product (Tausworthe, 1995). Then the quality is not absolute but based on the perspective of the assessor (Gentleman, 1997).

Understanding the ability of information system functions to meet business needs is very important for organizations (Peppard and Ward, 1999). One way is to explore the use and satisfaction of users to measure the effectiveness and success of information systems. User satisfaction in using information systems can affect the performance of these users (Gelderman, 1998). While the quality of the system has a direct and indirect impact on satisfaction (Gürkut and Nat, 2017).

Based on a literature, a conceptual model was made regarding the measurement of performance of the AIS. The conceptual model developed in this study is described as follows:

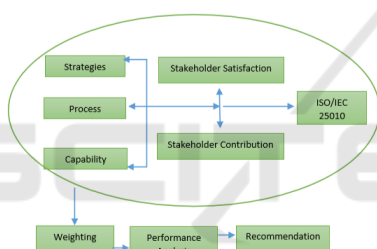


Figure 2: Conceptual Model

Figure 2 is a system measurement model by combining the performance prism model and ISO / IEC 25010. It can be seen in the picture that the satisfaction aspects of each stakeholder will be supported by strategies, processes, stakeholder contributions, and the ability of the system itself. Measurement indicators resulting from stakeholder satisfaction will be combined with existing measurement indicators in ISO / IEC 25010.

4.3 Analysis of Problem Solving

In this study, there are several stages in the analysis of problem-solving, namely:

4.3.1 Identification of Stakeholders

Done by collecting data which is directly involved in AIS based on discussions and interviews with the Head of IT Unit. The role of each stakeholder towards AIS is also identified to find out the role of each stakeholder so that stakeholder grouping can be identified.

The identified stakeholders have then grouped again into key stakeholders

4.3.2 Identification of the Five Facets of Performance Prism

Interviewing the determination of the facet of Prism's performance is conducted on all key stakeholders. Table 1 is the format of the questions asked during the interview grouping the five performance facets of Prism for each key stakeholder.

Table 1: Format for the Determination of Five Facets of Performance Prism.

Facets	Question
Satisfaction	What do you want and need from AIS?
Strategy	According to you, what strategies can be done to meet these wants and needs?
Process	What processes can be implemented to realize the strategy?
Capabilities	What abilities must AIS have in order for this process to be carried out?
Contribution	What kind of contributions can you make to AIS in supporting the process?

4.3.3 Mapping ISO/IEC 25010

At this stage, an ISO/IEC 25010 General overview is grouped according to AIS conditions. Next, a comparison of the five facets of performance prism identification for each key stakeholder is made based on a grouping of the ISO/IEC 25010 general picture.

4.3.4 Identification of Performance Indicators

After designing a general description of the quality of ISO/IEC 25010 and comparing with five facets of performance prism, the next step is to identify the performance indicators that refer to the results of comparison of five facets of performance prism of each stakeholder with an overview of ISO/IEC 25010. After that, the classification is done according to the basic framework of performance prism (Arianto and Partiw, 2009).

Table 2: Indicator for Performance Measurement.

Key Performance Indicator	Performance Indicator
Functional Suitability	Functions on AIS are capable perform tasks according to their respective goals
	AIS provides right results with the required level of precision.
	The function of AIS can facilitate the completion of tasks and goals that have been determined
Performance efficiency	Response and processing time as well as the level of AIS throughput when carrying out its functions meet the requirements
	The resources used by AIS in carrying out its functions meet the requirements
	The maximum limit or AIS parameter meets the requirements
Compatibility	AIS can perform the necessary functions efficiently while sharing the same environment and resources with other products, without harming other products.
	AIS can exchange information and use information that has been exchanged
Usability	Users can recognize whether AIS fits their needs.
	AIS can create users to understand the way easily operate AIS
	AIS is easy to operate and access
	AIS protects users from making mistakes.
	The user interface at AIS allows pleasant and satisfying interactions for users
	AIS can be used by people with the broadest range of characteristics and abilities to achieve the goals specified in the context of a particular use

Reliability	AIS is able to bear, handle or cover up the failures and errors that occur
	AIS operates and can be accessed when needed to be used
	AIS is able to maintain a certain level of performance in the case of software errors or violations committed by users
	AIS is able to rebuild performance levels and recover data that is directly affected by failures or interruptions
Security	AIS ensures that data can only be accessed by those who are authorized to have access.
	AIS prevents unauthorized access to, or modification of, computer programs or data
	In AIS an action or event can be proven to have occurred so that the development or operation cannot be denied later
	The actions of an entity on AIS can be traced uniquely to the entity The identity of the subject or resource at AIS can be proven as claimed
Maintainability	AIS consists of discrete components such that changes to one part have minimal impact on other components.
	An asset in AIS can be used in more than one system, or in building other assets
	AIS is able to diagnose the cause of failure and conduct failure identification
	AIS can be effectively and efficiently modified without introducing defects or reducing the quality of existing products
	System errors that appear on AIS can be fixed quickly
	The AIS Testing process is easy
Portability	AIS is easy to adapt or operate in diverse operating environments without applying other actions or rules

	AIS is easy to install/uninstall in certain environments
	AIS is easy to move to other sites where software has been built or specified
Timeliness	AIS operates according to the applicable schedule

Table 2 is the result of the identification of performance indicators after comparing the performance indicators obtained from performance prism with the performance indicators of ISO / IEC 25010. Merging the two models produces more complete performance indicators. These performance indicators will then be assessed by distributing questionnaires to competent respondents. The results of this questionnaire are the average values of each performance indicator.

4.3.5 AHP Weighting

At this stage, the AHP is weighted three times, the steps and weighting calculations refer to the AHP rules and formulas (Saaty, 2008). The weighting party is competent. It understands AIS, which in this case, is the Head of the IT Unit because the weighted criteria must be weighted according to company needs (Arianto and Partiw, 2009). Weightings carried out include:

1. Weighting among key stakeholders to determine the weight of interests of key stakeholders,
2. Weighting between 5 facets of Performance Prism for each key stakeholder, to determine the importance of the 5 facets of Performance Prism for each key stakeholder.
3. Weighting between performance indicators each stakeholder, this is to determine the weight of each performance indicator of each key stakeholder.

The weighting is based on interviews with the Head of IT Unit. Furthermore, the calculation is done based on AHP rules and formulas. The weighting of performance indicators and critical stakeholders is carried out to provide performance values based on the weight of their respective interests. While the weighting of 5 performance prism facets is used as a reference for future performance improvement if performance indicators that have poor performance are found.

4.3.6 Test Validity and Reliability

Validity and reliability tests are done to avoid inconsistent answers from respondents. SPSS can determine whether the answers given by respondents are appropriate to be included in the calculation or not. The rules used are as follows:

1. Kaplan and Saccuzo reliability test (1993), if Cronbach's alpha coefficient ≥ 0.77 , the results of the questionnaire can be said to be reliable.
2. Test the validity of the Product Moment (Pearson Correlation) method, if the value of Corrected Item - Total Correlation > 0.3 then the data can be said to be valid whereas if the Pearson Correlation value ≤ 0.3 then it is considered invalid

4.3.7 Scoring Value with OMAX

At this stage, a comparison of real performance indicator data obtained earlier through a questionnaire with a maximum target (level 10) and the worst possible condition (level 0). The calculation uses the OMAX formula (Riggs, 1981), which has been applied to the system built to help with the calculation. The real situation is obtained from the results of representative questionnaires from each key stakeholder. The result is a score (level) for each performance indicator using the interval formula in OMAX. The results of performance indicators will be seen in the Traffic Light System in the form of colors that describe the state of AIS performance. The results of performance values of each performance indicator are classified into the Traffic Light system according to the amount of each performance and in the form of 3 colors, namely red, yellow, and green. Because what is used in the performance appraisal is a Likert scale, the maximum target (level 10) and the worst conditions that may occur (level 0) are determined based on the upper and lower limits of the Likert Scale. The results of this traffic light system will show which performance indicators have been achieved, which have not been achieved as well as indicators that are far from the target and thus require recommendations for improvement.

4.4 Conclusion

At stage is concluded the answers to initial problem formulation and provide suggestions based on the results of the analysis that has been done. The conclusion is the final stage in the study, where the overall results of the discussion and data processing have been carried out. The conclusion also discusses whether or not the problem was raised, or a new problem arises that can be used as a suggestion for further research.

5 CONCLUSIONS

This study uses performance prism and ISO/IEC 25010 to design performance measurements of academic information system in the Poltekkes Kemenkes Surabaya. Performance prism is a measurement model that focuses more on stakeholders, while ISO/IEC 25010 is a model of measuring system quality with international standards. This method should be implemented for testing. This design produces indicators that can be used as a reference for measuring academic information systems and can later be used as recommendations for improvement. The indicators generated are based on the results of the interviews and literature review. To produce more detailed indicators, in-depth interviews with each stakeholder are needed. As well as from the conceptual model produced it needs to be implemented and used to measure the performance of information systems in future research.

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