Strategy for the Effectiveness of the Implementation of Academic Information Systems in College in Efforts to Improve Information Quality

https://doi.org/10.3991/ijim.v16i13.30601

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Abstract—The success of information systems research has begun to decline in the past few years, but existing research is still inaccurate in its definition and in the factors that affect the success of the information system. The purpose of this research is to find out, study, and analyze the effective strategy of implementing academic information systems in universities in an effort to improve the quality of information. The research was conducted using a qualitative approach and case studies, namely problem formulation, study proposition, analysis unit, data linkage to the proposition, the criteria for interpreting the findings and making conclusions and recommendations. From the results of the research data analysis, several conclusions were obtained, namely, the academic information system running in universities has not met expectations. The performance of academic information systems that can support the smooth operation of the universities is not well understood. It is necessary to formulate an optimal academic information system strengthening strategy that can support the smooth operation of the universities.

Keywords—system quality, information quality, service quality, information security

1 Introduction

For organizations, one of the most important needs today is information systems (IS). This is because information systems can help companies improve the efficiency and effectiveness of their business processes. The same applies to colleges, which are one of the institutions engaged in education [51]. To achieve efficiency and effectiveness, it is necessary to properly manage the information systems contained within the institution. It is hoped that through good management of the existing information system, the information system can support these institutions to successfully achieve their goals in the future. The success of institutional governance today is highly dependent on how the information systems governance is implemented [1].

1.1 Information system in general

According to [2], an information system is a collection of components that collect, process, store, and provide the output of any information needed in business processes and applications used through software, databases, and even manual processes related. According to [3] an information system is a system made in general based on a set of computers and manual components that can be collected, stored, and processed to provide output to the user.

Explanation of information systems according to the definition above can be concluded that a system is a group of elements that are interconnected with a predetermined purpose. The general model of a system consists of input, process, and output, as shown in Figure 1 below:

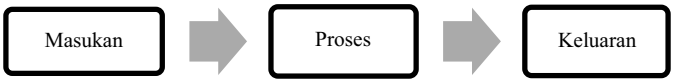

Fig. 1. The general model of the system

Thus, it can be concluded that the information system is an organized combination of modules derived from components related to hardware, software, people, and networks based on a set of computers and produces information to achieve goals.

1.2 College organizations in general

[4] defines the organization as a combination of behavior with the achievement of the expected and the choice or part of the existing task requirements of each individual in the organization. The goals of individual and group organizations in an organization can be achieved if they are supported by the presence of bureaucracy and work mechanisms [5].

Organizations are consciously coordinated social units, consisting of two or more people who function in a relatively sustainable manner to achieve common goals [6]. Another opinion says that an organization is a consciously coordinated system of the activities of two or more people [7].

From some of the definitions above, it can be concluded that an organization is a structured and coordinated system in which there is a work mechanism and bureaucracy that is carried out by a group of people on an ongoing basis so that organizational goals can be achieved.

According to [8] explained that higher education includes several programs, namely, diploma, bachelor, master, doctoral, professional, and specialist. According to [9], Education is an effort as a human being to develop and increase the potential in body and spirit with existing norms and values.

1.3 The importance of academic information system in college

The use of information systems determines the current organizational life cycle in the era of science and technology [10][52]. It is important to evaluate the performance of each system that has been implemented to understand the quality of the system's success in achieving the objectives previously set [11]. The level of success of an information system is measured by end-user satisfaction. This statement is in line with the explanation [1], one indicator of the success of information systems can be seen from the quality of user satisfaction.

Furthermore, [12], argued that there are at least two reasons for organizations to evaluate their information systems. The first is whether the information system provides benefits to the organization, and the second is whether the information system is worth keeping or needs to be changed. Both reasons are only concerned with the information system itself, while some other researchers, such as [13]–[17], also suggests evaluating the impact of organizational culture on the implementation of information systems. This implies that assessing the success of information systems will yield plausible results if the organizational context is ignored.

[18] also revealed that individuals who do things using a certain system will improve their job performance. Information systems will also greatly affect the level of success of organizational governance [19].

In the research conducted by [20], integration of business functions is obtained through the Information System / Information Technology Master Plan (IS / ITSP). The IS / ITSP model was formed based on the mapping of Critical Success Factors using the IT Balanced Score Card (IT BSC) which combines 3 (three) strategies, namely the Business Information System Strategy, the Information Technology & System Management Strategy, and the Information Technology Strategy obtained through business environment mapping and Information Systems & Technology environment internally and externally. Can be seen in Table 1 below is a description of the effectiveness of the information system used by one of the tertiary institutions.

Table 1. College information system users

Variables	2015		2016		2017		2018		2019	
	Total	**Access**	**Total**	**Access**	**Total**	**Access**	**Total**	**Access**	**Total**	**Access**
Faculty Full Time	81	71	83	79	90	79	93	83	97	75
Faculty Part-Time	192	106	196	120	209	119	247	103	243	120
Staff	82	29	85	38	85	35	92	35	93	31
Student (Undergraduate)	831	592	983	687	1124	664	1202	632	1549	454
Student (Graduate)	1644	728	1717	1045	2233	914	2294	857	2304	889
Total	2830	54%	3064	64%	3741	48%	3928	44%	4286	37%

Based on the table, it can be seen that along with the increase in the number of users in the college, it is not accompanied by an increase in the effectiveness of existing users based on the total number of accesses from year to year. The total users from 2015–2019 are always increasing, but the total users who access are decreasing, starting from 2015 which is only 54% or as many as 1,526 users of the total users should be, in 2016 only 64% or 1,969 users, in 2017 it started to experience The largest decrease from the previous year was 48% or 1,811 of the total users should have, in 2018 it decreased to 44% or 1,710, and in 2019 its effectiveness tended to decrease until it reached 37% or 1,569 which could be interpreted as the lowest compared to previous years.

One of the new regulations implemented by the Ministry of Education and Culture during the Covid-19 pandemic is an online learning system carried out at various levels of education [53]. Based on the statement of the Minister of Education and Culture of the Republic of Indonesia (2019), "School digitization is a breakthrough in the world of education by utilizing developments in information technology in various aspects of teaching." School digitization is the main program that the Ministry of Education and Culture will undertake in 2021.

According to [21], that information technology facilities are standard learning tools. Based on these regulations, universities need to prepare good information technology infrastructure.

The main objectives of academic information systems are to improve performance and service quality, as well as to create an online information system, make it easier for users to find academic information, as a guide to help improve academic effectiveness or transactions, for example seeing courses offered, accessing learning outcomes, entering lesson plans, see final transcripts and other teaching activities. The system is not only provided for students, but also for lecturers which include: Lecturer performance load (BKD).

In the process of organizing academic activities, speed and accuracy of data processing is required. The data processing includes payment registration, study plan card (KRS), attendance entry, test scores, and will produce a Study Result Card (KHS), inputting letters, processing and managing funds, the recapitulation of complaints, submitting the registration, submitting legalization, and operational management.

In this process, there are often obstacles such as delays in filling out the system by students and academic staff. This delay has a major impact on the teaching process and controlling information so that the data/information provided in other parts is less than perfect. Inaccurate data can cause other work to stop, for example, late KHS preparation time, and other information on the academic information system is not updated.

Based on this information, the researcher conducted a SWOT analysis to show external and internal factors that could influence the strategy for implementing the effectiveness of the information system. The image below shows the details of the SWOT analysis obtained by the researchers for this study.

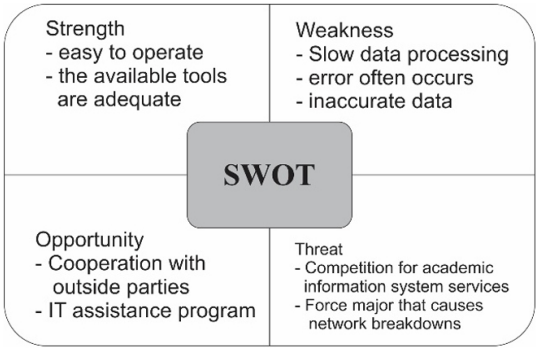

Fig. 2. SWOT analysis

From the SWOT results than analyze internal factors and external factors. The results of the internal and external analysis can be seen that the current condition is still in a positive position but within a limit that is approaching negative, therefore it is necessary to have a strategy for implementing the effectiveness of information systems so that an increase in the quality of information can occur.

1.4 Research proposition

The propositions raised in this study are as follows:

1. Improving the system quality of the academic information system.
2. The quality of information produced by the academic information system needs to be improved.
3. Improving the quality of higher education services with an academic information system.
4. It is necessary to increase awareness of information security in tertiary institutions.

From the conclusion of the proposition above, it is necessary to formulate a strategy to increase the effectiveness of information systems in tertiary institutions to improve the quality of information.

2 Literature review

2.1 Operation management

Before discussing operations management, we will first discuss a little about management. [22] states that management is a process of planning, organizing, coordinating, and controlling resources to achieve targets effectively and efficiently. According to [23] defines management is the achievement of organizational goals effectively and efficiently through organizational planning, leadership, and control of organizational resources.

[24] Defining management is a process carried out to achieve organizational goals in the form of clear, assertive, and empathetic communication, integrity, encouraging and motivation, respect for others, and being able to be a team player and work together effectively.

According to [23] defines management is the achievement of organizational goals effectively and efficiently through organizational planning, leadership, and control of organizational resources. From some of the definitions above, it can be concluded that management is defined as the process of planning, organizing, directing, and controlling the use of resources owned, respecting each other, motivating and encouraging, between work teams and being assertive, empathetic, and communicated so that organizational goals can be achieved efficiently and effectively. The function of management itself according to [25] are grouped into five functions, namely planning, organizing, staffing, leading, and controlling.

According to [26] Operations management is defined as an operating strategy that can be carried out in several ways, including improving quality, revenue, time, reliability, flexibility in operation, and cost reduction.

Operations management is a function or system that performs input-output processing activities with great added value [27]. Meanwhile, according to [28] operations management is the science and art of ensuring that goods and services are created and delivered successfully to customers.

According to [29], Operations management is a series of activities that generate value in the form of goods and services by converting inputs into outputs. Operations management is defined as the field of management that specializes in the production of goods and uses special tools and techniques to solve production problems [23].

According to [29], companies achieve their mission in three ways namely competing on differentiation, competing on cost, and competing on response. Important strategy formulation is integrated into 3 stages of the decision framework, namely the input stage, the suitability stage, and the decision stage. The three existing strategies each provide an opportunity for operations managers to gain a competitive advantage. Competitive advantage means creating a system that has a unique advantage over other competitors. The idea is to create customer value efficiently and effectively.

From many of the definitions above, it can be concluded that operations management is an operations strategy that generates added value through a series of resource transformation processes and ensures that the resulting output is successfully delivered to customers.

2.2 Quality management

Various concepts regarding the quality control function have evolved over the years. [30] argues that most of these concepts were developed as a reaction to the success of this idea in Japan. These concepts are intended to bring attention to the need for quality control by every employee in the organization. One of the initial ideas about this was the so-called 'Total Quality Control' put forward by [31]. Feigenbaum emphasized that

the responsibility for quality control lies with the entire department, not just the quality control department. The entire scope of quality management has been described by Juran in his book "Guide to Quality Control", which states the need for leadership for top management and an extensive training program to equip all employees with quality control techniques.

Besides, various methods and tools for quality control concepts have been developed, such as 'Control Chart Method', Pareto Diagram, and 'Cause and Effect Diagram or Ishikawa Diagram'. The combination of Statistical Quality Control, Continuous quality improvement, quality planning, modern quality systems, and strategic quality planning becomes what is called Total Quality Management (TOM). The company has introduced methods of quality control, quality improvement, and quality planning for management. Here the emphasis is not only on the business process as a weapon to win the competition but also on an opportunity to increase efficiency. With the increasing scope of the quality system, it appears that quality is no longer a tactical issue but has become a strategic issue requiring senior management leadership. Substantial pressure to implement TQM and achieve the target of a 'world-class quality system' has led to quality standards and certifications both nationally and internationally, such as ISO 9000-2000 and ANSI / SO / ASQ / Q9000-2000.

System quality. According to [32], The system is a series consisting of two or more components that are interconnected and interact with each other to achieve the same goal. According to [3], The system is a set of interdependent elements that together achieve certain goals. Thus it can be concluded that the system is a set of interconnected elements that together achieve a certain goal in an orderly process that can support a larger system and are interdependent to achieve certain goals.

According to [33] regarding the quality of information system as follows:

"Quality of information Systems can be viewed from multiple perspectives. From a technical perspective, it can focus on the efficiency of Systems and processing. From a business point of view, it can focus on an increase in profitability. From the user's point of view, it can focus on the increased case of use in a system and support of their work practices."

According to [34] that:

"The quality of the information system is characteristic of the inherent information regarding the system itself."

The quality of the information system is also defined by [34] as follows:

"The quality of information systems is defined as perceived ease of use, which is how much computer technology is felt to be relatively easy to understand and use."

The above statement states that if users of information systems feel that using the information system is easy so that they can improve their overall performance, the information system is of quality. An information system can be said of quality if the system is designed to meet user satisfaction through the ease of using the information system. [35] state that:

"The quality of information systems is the quality of a product or service which is generally measured based on the suitability of the user with the information system, where the information system can be applied according to what the user wants."

Based on some of the statements above, it shows that the quality of the information system is the quality of the information produced whether it has good information characteristics and is useful for information users. A quality information system can be used according to the wishes of the users and can produce accurate, timely, relevant, and complete information.

Information quality. According to [3] information is data that is presented in a form that is useful for decision-making activities. According to [32], Information is data that has been managed and processed to provide meaning and improve the decision-making process. Thus, it can be concluded that information is data that is processed into a form that is more useful and meaningful for those who receive it in decision-making activities.

Bodnar and Hopwood are translated by [36] define the quality of information as follows:

"The quality of information is the level at which data that has been processed by the information system has meaning for its users, which can be in the form of facts and a useful value."

According to [37] information quality as follows:

"Information quality that is, information products whose characteristics, attributes, or qualities help to make the information more valuable to them."

According to [38]:

"Information quality measures the quality of the output of the information system."

According to [39] that:

"Quality information is information that has three criteria, namely accurate, timely and relevant."

Based on some of the above definitions, information quality is the quality of output in the form of information produced by an information system. The quality of information is centered on how the users of the information assess the usefulness or importance of the information.

Quality of service. According to [40] service quality is a measure of how good the level of service provided is following consumer expectations. Based on this definition, service quality is determined by the company's ability to meet consumer needs and desires under consumer expectations.

[41] said that quality or quality in the service industry is a presentation of a product or service according to the prevailing size at the place where the product is made and the delivery is at least the same as what consumers want and expect.

According to [42] states that what is meant by service is an action or action offered by one party to another party, which does not have a form and does not lead to ownership in any form.

According to [43], "Service quality is centered on fulfilling the needs and desires of consumers as well as the accuracy of its delivery to balance consumer expectations, namely the conformity between expectations and management perceptions, the conformity between perceptions of consumer expectations and employee work standards, conformity between employee work standards and services provided with the promised service and the conformity between the service received and the one expected by the consumer."

Based on some of the above definitions, the writer concludes that service quality is a product or service presentation that is under company standards and strives to deliver these products and services the same as what restaurant guests expect or exceed guests' expectations.

2.3 Information security awareness

Information is an asset that must be protected by its security. Security is generally defined as "quality or state of being secure-to be free from danger." According to [44], What is meant by information security awareness is a dynamic process that develops following the development of the situation.

According to [45], disclosed that one of the triggers for violations of information security is because information technology users have inadequate awareness of using information technology safely and many also have adequate capabilities but do not care about it.

Based on some of the above definitions, the authors conclude that information security awareness is an act or act that is carried out consciously to safeguard the personal information that is owned and must be developed following the development of the situation.

To be safe is to be protected from enemies and danger. An example of an information security review from [46] as follows:

1. Physical Security
2. Personal Security
3. Operation Security
4. Communications Security
5. Network Security

Each of the above components contributes to the overall information security program. Information security is the protection of information, including systems and devices that are used, store and transmit it. Information security protects information from various threats to ensure business continuity, minimize damage caused by threats, and accelerate the return of investment and business opportunities.

3 Methodology

The methodology used in this study is the Literature Review method. The reason for using this method is because this study aims to solve dynamic problems by utilizing previous research in the form of papers, journals, or books. The process of the Literature Review method can be seen in Figure 3 below.

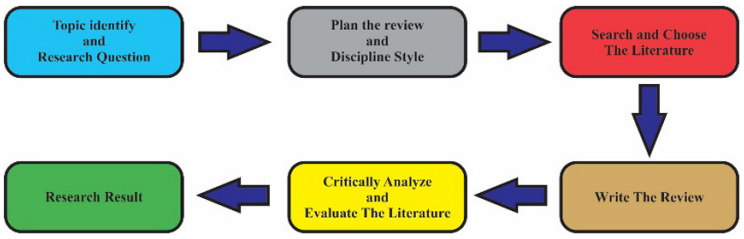

Fig. 3. Literature review process

4 Results and findings

4.1 Strategies for the effectiveness of academic information systems in improving system quality

Measuring quality in an information system is not an easy matter, this is because there are no definite criteria that become standards in measuring the quality of the information system itself. Measuring the quality of the system can be done by analyzing a system that is already running in an agency. Measuring the quality of an information system according to [47] as follows:

1. The convenience of Access,

An information system that can be learned and understood easily when it is used for the first time by its users. Besides, the information system is easy to operate and following the needs of the user.

2. System flexibility,

An information system is said to have a flexible system if the information system can solve user problems in several different ways. The flexibility of the system in adapting itself to the wishes of the user or the user's ability.

3. System integrity,

A system that can be accessed easily by its users and also cannot be accessed by unauthorized users. System integrity can also be seen from the ability of the information system to find errors in the process.

4. Response time,

A system that has a short time to respond from users and can also perform fast processing.

The system quality of the information system can have a big effect on the level of user satisfaction. Users of academic information systems in tertiary institutions will be helped if the system can speed up and also facilitate work, is flexible with user desires, is easily accessible, and can provide the desired output quickly. By considering several

measurement points previously mentioned, the strategy for the effectiveness of academic information systems in improving the quality of this research system can be seen in Table 2 below.

Table 2. Strategies for the effectiveness of academic information systems in improving system quality

Measure	Strategy	Expectation
Convenience Access	1. Get to know the characteristics of the user. 2. Make content and features easy to understand 3. Keep it simple.	Users can easily understand the academic information system and are comfortable in use.
System Flexibility	1. Provide additional options or shortcuts in system features. 2. Provides several other options for solving. problems or providing information for the user.	The user can have several options to get information or solve the problem.
System Integrity	1. Using a user verification system that is easy to do. 2. Enforce encryption security on user data.	Users can easily access academic information systems and increase confidence in data integrity.
Time Response	1. Efficient in the program coding process to maintain program efficiency. 2. Good server maintenance to maintain data communication with the server.	The user can get information or solve the problem quickly.

4.2 Strategies for the effectiveness of academic information systems in improving information quality

To assess the quality of information can be seen from the dimension of information quality. Information is said to have good quality if the information can meet the expectations and needs of the users of the information. According to [48], Quality information can help improve the quality of understanding of users of the information in viewing and analyzing changes that occur within the agency, to accelerate and help improve accuracy in responding to changes in information that occur.

The dimension of information quality can be a basis for assessing the quality of information. According to [48], information that has good quality can be seen from the following dimensions:

1. Accurate,

The information must be accurate because inaccurate information can cause interference such as changing or destroying the content of the information. Accurate information means that it is not error-free and does not mislead its users and must also have a purpose.

2. Relevant,

Relevant information means information that has benefits for its users, information that is following what is needed and can be used by those who need it.

3. On-time,

Information reaches the user on time because late information will reduce the value of the information. This is because information can be the basis for making a decision and can have fatal consequences if the important information needed is not obtained on time.

4. Complete,

Information is provided in a clear, detailed, and concise manner as required by the user.

By considering several measurement points previously mentioned, the strategy for the effectiveness of academic information systems in improving the quality of research information can be seen in Table 3 below.

Table 3. Strategies for the effectiveness of academic information systems in improving the quality of information

Measure	Strategy	Expectation
Accurate	1. Information is obtained by users directly from the relevant section through the academic information system. 2. Data audits are carried out to maintain the accuracy and correctness of the information.	Users can obtain information that is accurate and not misleading.
Relevant	1. Deepen understanding of data communication flow in system business processes. 2. Customization of information provided for each access right or each type of user.	Users can obtain information following what they need and are useful for themselves.
On-time	1. Use an alert or reminder system when important information must be conveyed at a time. 2. Use of planning or scheduling features for information that must be conveyed in the future.	Users can obtain information in a timelier manner and can help facilitate decision-making.
Detail	1. Understanding of the information needs to be required by users. 2. Understanding of the details of the information submitted.	Users can get information clearly and completely as needed.

4.3 Strategies for the effectiveness of academic information systems in improving service quality

According to [40], service quality can be used as a benchmark in measuring the level of service provided whether it is following user expectations. Quality or quality in a service industry is a presentation of a product or service following the provisions and measures set at the agency and delivered in the manner expected by the user, [49]. According to [41], there are quality sources that can determine the quality of service, including:

1. Production Quality,

This explains that the quality of service can be determined by the production and marketing parties.

2. Delivery Quality,

This explains that the quality of service can be determined by the way services are delivered by universities to users.

3. Design Quality,

This explains that the quality of service can be determined from the first time an information system is designed to meet user needs.

4. Relationship Quality,

This explains that the quality of service can be determined by the professional and social relationships between universities and users.

Next as said by [40], there are five main dimensions in measuring the quality of service, including:

1. Reliability,

Higher education institutions can maintain reliable service delivery and minimal errors for a long time so that it can build user trust.

2. Responsiveness,

Related to the ability and also the willingness of employees to be able to help users and also respond to requests, and also provide quick responses.

3. Guarantee,

Relating to the behavior of employees can help increase user confidence in higher education. The guarantee can also be in the form of employees' ability to master the running system so that they can handle problems or questions raised by users.

4. Empathy,

It means that the university understands the problems faced by users and can act to solve these problems for the benefit of consumers, besides that the college also pays personal attention to users and is ready to help.

5. Physical Evidence,

This is related to the attractiveness in the form of real facilities such as complete and well-organized technological devices that are clean and tidy so that it can give a good impression to the user.

By considering several key dimension points in measuring service quality that has been previously mentioned, the strategy for the effectiveness of academic information systems in improving the quality of research services can be seen in Table 4 below.

Table 4. Strategies for the effectiveness of academic information systems in improving service quality

Measure	Strategy	Expectation
Reliability	1. Maintain academic information systems regularly to maintain quality and fix if there are errors.	Can build user confidence in the capabilities of academic information systems.
Responsiveness	1. There is a real-time communication feature to users so that they can immediately provide feedback or assistance when needed by users. 2. There is a help desk officer who is ready to assist users in using the academic information system.	Users can get help or responses from the college faster.
Assurance	1. Conducting training for college employees on how academic information systems work. 2. Provide documentation of the academic information system clearly to employees.	Employees can better master and understand the academic information system so that they can better help users.
Empathy	1. There is a questionnaire feature provided to users. 2. Study and process feedback provided by users regarding academic information systems.	Higher education institutions can better understand users of academic information systems to improve service quality in the future.
Tangible	1. Perform hardware maintenance where users routinely use academic information systems. 2. Perform inventory data collection on technology owned by universities.	Users can use the academic information system on hardware comfortably and are interested in using it.

4.4 Strategies to increase information security awareness in college

Information is an asset that is very important to protect its security. A college or an agency is required to be able to maintain information security from leaks or system failures that can result in fatal losses. According to [50] information security has 3 main achievement goals, namely confidentiality, integrity, and availability.

Security awareness is an arrangement designed to reduce errors in information security resulting from negligence or planned actions [46].

Information security has three basic principles, including the following:

1. Confidentiality,

It is information security by guaranteeing access rights to information to users who have the right to access that information.

2. Integrity,

It is information security by guaranteeing the completeness of the information and also protecting the information from damage or alteration of information from irresponsible parties.

3. Availability,

It is information security by ensuring that users can always access the required information at any time without any interference.

By considering several key dimension points in measuring service quality that has been previously mentioned, the strategy for the effectiveness of academic information systems in improving the quality of research services can be seen in Table 5 below.

Table 5. Strategies for the effectiveness of academic information systems in increasing awareness of information security

Measure	Strategy	Expectation
Confidentiality	1. Application of access rights restrictions on each type of user account.	Can maintain the access rights of each user account of the academic information system.
Integrity	1. Application of data encryption in academic information systems.	Can improve data integrity by reducing the possibility of data changes by parties that are not supposed to.
Availability	1. Good database management implementation and routine data availability checks.	Users can always access the information they need at any time.

5 Conclusion

The quality of academic information systems in tertiary institutions still needs to be improved, especially in improving the quality of systems, information, and services. Besides that, the awareness of tertiary institutions and academic system implementers of information security can also be said to be lacking. However, this can be improved by implementing an effective strategy for implementing academic information systems. To improve system quality, the application of opinions from [47], improving information quality by applying the opinions of [48], improving service quality by applying the opinions of [40], and finally increasing awareness of information security by applying [46]'s opinion.

6 Acknowledgment

This research was conducted independently at a tertiary institution in Indonesia. Many thanks to the Promoter, Co-Promoter, and friends who have helped this research to run.

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Article submitted 2022-03-03. Resubmitted 2022-05-09. Final acceptance 2022-05-09. Final version published as submitted by the authors.