



Evaluating The Application of Library Information System Technology using The PIECES Method in Remote Areas

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Abstract

Over five years, the implementation of the library information system at IKIP Muhammadiyah Maumere faced a challenge, frequent errors during data input that hindered users from fully utilizing the system. These issues not only affected users' interest but also highlighted the significance of the human factor in shaping the quality of an information system. To make full use of the system, it was crucial to identify and address the problems associated with it. This research delved into the experiences of 242 library information system users, including lecturers, students, and librarians, by using the PIECES method. The goal was to analyze users' satisfaction and uncover any underlying issues within the system. The results of the PIECES analysis revealed average satisfaction scores, showcasing users' contentment with the system's performance (3.77), information (3.79), economy (3.80), control (3.77), efficiency (3.77), and service (3.89). These findings suggest that the library information system has been meeting users' expectations. However, a significant problem emerged in the performance variable, particularly in the system stability. Additionally, issues related to data compatibility, duplication in storage, and users' authority management, access control, and system errors were observed in the information and control variables. Based on these identified challenges, recommendations for system improvement were made by targeting low satisfaction levels. Proposed solutions involve enhancing data management, storage practices, user access control, and reducing the risk of system errors, ensuring more efficient and reliable library information system.

Keywords: PIECES; Problem Identification; System Development Recommendations; User Satisfaction.

Introduction

Libraries have been a famous place to people around the world for hundreds of years and is commonly considered a repository of information [1]. The organization of libraries in the present time utilizes information system, a collection of material devices from software, hardware, and brainware connected and mutually helpful in managing data that is useful for its recipients [2]. Information system tools manage formal procedures where data is collected, operated into information, and data is disseminated for user needs [3]. The library information system uses information technology to realize the ideal library according to user needs [4]. The ideal library is a library that has four elements, namely a complete library collection; library managers have extensive connections; fast, precise, and easy access to manual or online information services; and a routine agenda to increase reading interest and attract users [5]. The collections of the library is always updated online to make it easy for stakeholders to access information they need. It will save more time than directly coming to the library. The use of library information systems can ease and increase the efficiency of library users such as students to study or work on their assignment [6]. The library information system is designed to manage the library's operations, such as keeping the library collection data, facilitating data collection from library storage, borrower/member data, cataloging, and managing the course of library storage [7]. A quality system must be appropriate, meet set standards, and always keep up with the times and technological advances. A system that can meet user needs will significantly affect their satisfaction [8]. Various management information systems in education have been applied at educational system from elementary school to university.

IKIP Muhammadiyah Maumere is a teaching and educational institution managed by Muhammadiyah Maumere in a town of eastern Indonesia. Technological developments in eastern Indonesia are still relatively low, including in the IKIP Muhammadiyah Maumere. Academic and student administration activities are still carried out manually. For example, filling out study plan cards, performance report card, attendance, and distributing first-year admission brochures were conducted manually to high schools. In general, the management of the dominant information system used a manual system, so there was a need for information system application technology to facilitate all activities of the IKIP Muhammadiyah Maumere. In 2017, the institution utilized a library information system called the Central Library of IKIP Muhammadiyah Maumere. The implementation of the IKIP Muhammadiyah library information system was an innovation in the use of website-based information technology that offered an ease of service of users and library staff. The IKIP Muhammadiyah Maumere library information system was designed using SLIMS 8.3.1 (AKASIA). Its features facilitated the service of archiving book data, references, and label printing. The available features include a book borrowing system, book returns, book search catalogs, e-books, and others. **Figure 1** is the home menu display. It can display various features and a member area display for user login.

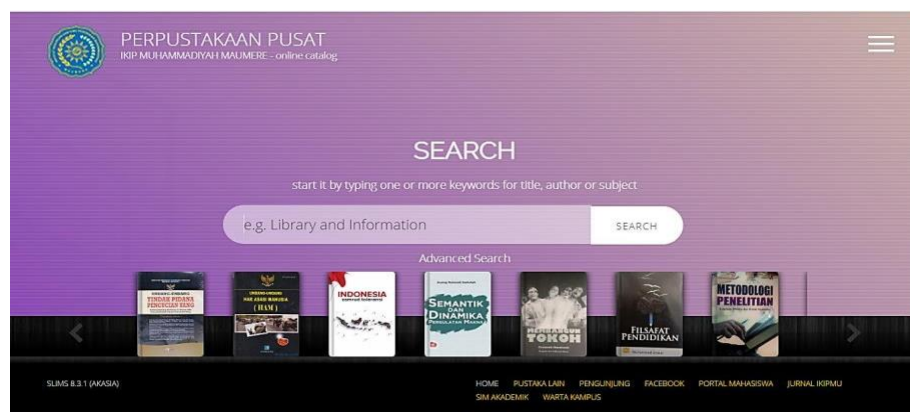


Figure 1. Home Menu Display System Information Library

During the five years of online library implementation services, users experienced less optimal use in the library information system because there were frequent errors when operating the system [9]. This problem certainly affected the activities of library users, so it was necessary to evaluate the system as a basis to develop the system. The evaluation was very useful to provide prospective users an information system which can meet the needs of individuals and libraries in improving their performance [10]. The main purpose of a system was to process data to obtain information, so it must be supported by the hardware, software, and brainware or humans as system users [11]. This research focused on brainware to identify information system problems. A system that can meet user needs will significantly affect user satisfaction [8]. In some efforts on deep learning studies, not all researchers report computational costs, but more depending on model scoring [12]. The model that can be used to identify various information system problems is the Performance Information Economy Control Efficiency Service model or method commonly called PIECES [13][14][15][16].

The PIECES method is a systematic evaluation method to identify problems by measuring performance, information, economy, control, efficiency, and services [17][18][7]. PIECES analysis has six variables; the first is performance. It is the first variable that has an important role in assessing whether the process or procedure being carried out still needs to be improved and it can provide the benefits of information systems as required. System performance is seen from the number of works/outputs/deliverables that can be done/produced at a certain time and the required time in operating the system to reach the desired destination [19]. The second is information judging, it analyzes the existing procedures either they can still be utilized to improve the quality of information obtained. The information displayed should be useful. If the capabilities of the information system are good, then the user will obtain accurate information, timely, and showing expected information [20], costs from economic perspective [21]. The third is the economy. It analyzes how to increase the procedures used or lower the cost of using the system [22]. The fourth is control, it measures system procedures if they need to be improved. Quality control must be improved, and the ability to find errors/crimes should also be improved. System integrity and security are used as criteria for control variables [3]. The fifth is Efficiency, it assesses the procedures used either they still need to improve its efficiency in operating the system better than conventional or manual systems [19]. Lastly, service measuring system users must be improved, especially the user-friendly service quality. Good service will describe the quality of an institution, so services must be considered properly [23].

The library information system needs to be continuously developed to meet the users' needs and enhance their satisfaction. Previous research only evaluated the level of user satisfaction but did not fully uncover the issues within the library information system [4][14][24]. By identifying these shortcomings, the new research can focus on efforts to address these weaknesses and provide a fresh contribution in implementing the PIECES method more comprehensively to enhance user satisfaction and create an ideal library information system. The PIECES method is expected to be able to find library information system problems so that it is optimal in developing a system that meets user needs. The aim of implementing a library information system is to meet the user needs, create an efficient system and increase library user satisfaction.

The quality of the library information system affects user satisfaction. Satisfaction is a condition that users feel after performing a task, either it meets their expectation or not [24]. The information system user satisfaction is one of the benchmarks for the implementation success rate in the form of an assessment related to the quality of system performance, whether it is appropriate or not according to the needs of its users [24]. An assessment on quality or service can be seen with two aspects: judgment on the experience of using the services and on the desired services [25]. The quality of the information system greatly influences user satisfaction. The objective of this study is to evaluate library information systems from user experience by using PIECES method as the analysis.

Method

This research consists of eight stages, namely determining the population and samples on the IKIP Muhammadiyah Maumere campus, compiling research instruments using the PIECES method variables, testing research instruments with validity and reliability tests, analyzing the results of filling out questionnaires, concluding the results of questionnaire analysis, and the final stage is providing development solutions if there are variables do not meet the expectation. The following [Figure 2](#) is the flow of the research.

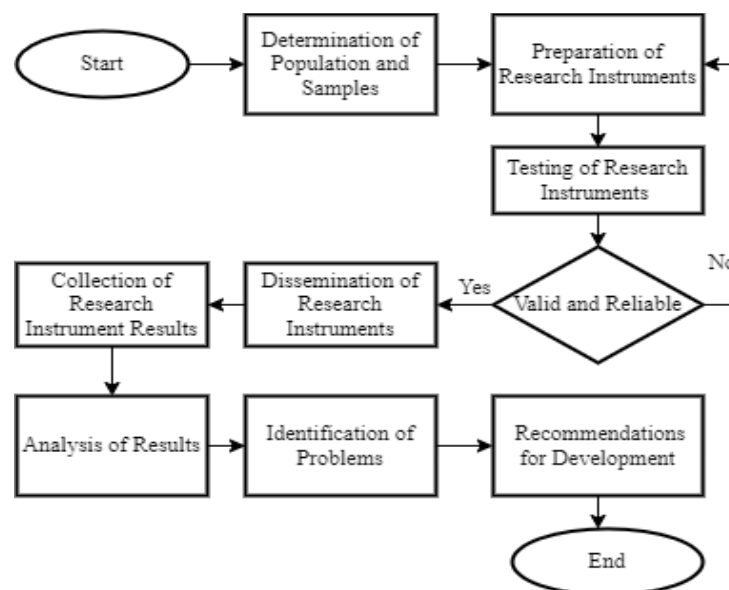


Figure 2. Research Flow

A. Population and Sample Determination

The sample was taken from the population, all IKIP Muhammadiyah Maumere library users. The population consists of lecturers, students, and librarians, with overall 613 users. Determination of research samples using the Slovin Equation with the selection of random samples. The number of samples (n) from the population (N) with error tolerance limit (e) was 5% or 0.05 [26][27]. The [Equation 1](#) is defined as follows.

$$n = \frac{N}{1 + N(e)^2} \quad (1)$$

The respondent of this study is 242. Grouping the characteristics of respondents by gender and study program/librarian. In [Figure 3](#), the diagram presents the characteristics of respondents by gender. The analysis of filling out the questionnaire showed that there were 88 male respondents and 154 female respondents. In [Figure 3](#), the percentage of female respondents was 63.6%. It is higher than the percentage of male respondents with a percentage of 36.4%. So There are more female respondents than male respondents.

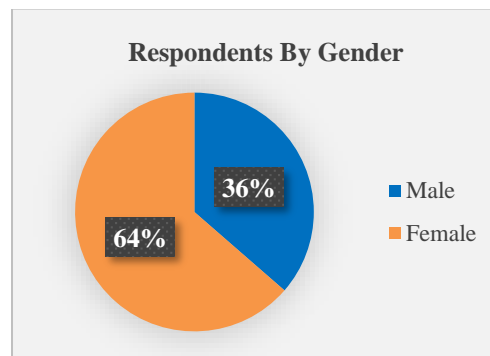


Figure 3. Chart of Respondents' Characteristics By Gender

The presentation of the characteristics of respondents based on the study program/librarian is show in **Figure 4**.

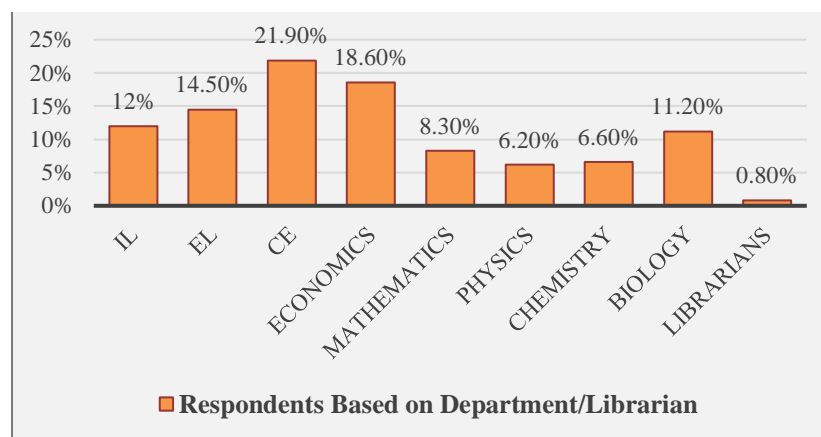


Figure 4. Diagram of Respondents' Characteristics Based on Department/Librarian

Figure 4 shows the distribution of the respondents. 29 respondents, or 12% of the totaled respondents, are students and staff from the department of Indonesian Language (IL), and English Language (EL) totaled 35 respondents with a percentage of 14%. Then, Civic Education (CE) amounted to 53 respondents with a percentage of 22%, Economics amounted to 45 respondents with a percentage of 19%, Mathematics amounted to 20 respondents with a percentage of 8%, Physics amounted to 15 respondents with a percentage of 6%, Chemistry totaled 16 respondents with a percentage of 7%, Biology totaled 27 respondents with a percentage of 11%. Librarians totaled 2 respondents with a percentage of 1%. Based on the characteristic diagram of department respondents/librarians in **Figure 5**, shows the dominating analyzed data of the Civic Education (CE) department.

B. Preparation of Research Instruments

This research instrument was a questionnaire. It was prepared based on user satisfaction indicators such as performance, information, economy, control, efficiency, and service variables [28]. The content and language composition of the questionnaire were adapted according to the user experience discussed with the IKIP Muhammadiyah Maumere Library. **Table 1** is a grid of indicators of the PIECES Method questionnaire.

Table 1. Grid of indicators of the PIECES method questionnaire

| Variable | Number | Statement |
|-------------|--------|--|
| Performance | A1 | The online library is very accessible to users |
| | A2 | The online library can operate some commands in a relatively short time without obstacles |
| | A3 | The online library, in response to an annulment order and request for a transaction, is made quickly and appropriately |
| | A4 | The amount of data that the online library can process in a time meets my expectation |
| | A5 | When the library is used simultaneously, the system's performance remains stable |
| | A6 | The total time needed in the data processing to produce information is done quickly and appropriately |
| | B1 | The online data in the library are already stored accordingly by |

| Variable | Number | Statement |
|-------------|--------|--|
| | | the system |
| Information | B2 | The online library does not keep data that should not be there |
| | B3 | The online library cannot store the same data, so it does not cause duplication or redundancy of data |
| | B4 | Data in the online library is already stored in a storage media |
| Economic | C1 | The cost is lighter with the presence of an online library compared to using conventional library |
| | C2 | The presence of online library content provides an advantage for users |
| | D1 | The security form of online libraries can already maintain data or information from various forms of fraud or crime |
| Control | D2 | The security system in the online library is good |
| | D3 | Management in providing authority and determining access control to the use and operation of online libraries is clear |
| | D4 | The storage media can properly organize data |
| | D5 | The system never error when it's used |
| Efficiency | E1 | The system used now will ease users in terms of time and cost |
| | E2 | The operating systems can monitor the library activities according to minimal time and material |
| Service | F1 | The online library is easy to use |
| | F2 | Aa a user in need of information, I am satisfied with the online service of the library |

The library information system questionnaire consists of 21 statements with an indicator framework of each PIECES variable. The assessment of each indicator question uses the likert scale to measure the answers according to the user satisfaction to the system. **Table 2** of the likert scale assessment weights [18].

Table 2. Likert Scale Grading Weights

| Criterion | Strongly Agree | Agree | Undecided | Disagree | Strongly Disagree |
|-----------|----------------|-------|-----------|----------|-------------------|
| Code | SS | S | R | TS | STS |
| Value | 5 | 4 | 3 | 2 | 1 |

The questionnaire was designed using google forms to make it easier to distribute to respondents online [29]. The questionnaire displayed on google forms matches the PIECES variable indicator grid and the assessment based on the weight of the likert scale.

C. Testing of Research Instruments

Before dissemination to respondents, questionnaires used as research instruments were tested for validity and reliability. Testing needs to be carried out to determine the feasibility of research instruments with validity and reliability tests [30]. The testing stage of a study requires complete data and information [31][32]. If the test results are not valid and reliable, the questionnaire is reordered until it meets the instrument feasibility test [33]. The following are the validity test results in **Table 3** based on calculations of IBM SPSS version 22 tools.

Table 3. Validity Test Results

| Number | r value | r table | Result |
|--------|---------|---------|--------|
| A1 | 0.704 | 0.279 | Valid |
| A2 | 0.616 | 0.279 | Valid |
| A3 | 0.601 | 0.279 | Valid |
| A4 | 0.811 | 0.279 | Valid |
| A5 | 0.822 | 0.279 | Valid |
| A6 | 0.865 | 0.279 | Valid |
| B1 | 0.784 | 0.279 | Valid |
| B2 | 0.873 | 0.279 | Valid |
| B3 | 0.869 | 0.279 | Valid |
| B4 | 0.753 | 0.279 | Valid |
| C1 | 0.895 | 0.279 | Valid |
| C2 | 0.794 | 0.279 | Valid |
| D1 | 0.733 | 0.279 | Valid |

| Number | r value | r table | Result |
|--------|---------|---------|--------|
| D2 | 0.644 | 0.279 | Valid |
| D3 | 0.750 | 0.279 | Valid |
| D4 | 0.793 | 0.279 | Valid |
| D5 | 0.815 | 0.279 | Valid |
| E1 | 0.787 | 0.279 | Valid |
| E2 | 0.858 | 0.279 | Valid |
| F1 | 0.856 | 0.279 | Valid |
| F2 | 0.847 | 0.279 | Valid |

Validity testing uses a significant accuracy rate of 95% and 5% error. If the r value is more than r table and alpha 5% then it is declared valid [20]. The number of test respondents consisted of 50 respondents with a significant degree or r table = 0.279. Based on the test results, it is shown in Table 2 that all r tables > r value, then the questionnaire statement is declared valid. The reliability test in Table 4 as follows.

Table 4. Reliability Test Results

| Cronbach's Alpha | N of Item |
|------------------|-----------|
| 0.931 | 21 |

In Table 4, the results of the SPSS calculation obtained an alpha value of 0.931 with 21 items. The alpha value is known to be more than 0.70, so the questionnaire is declared reliable used as a research instrument [13].

D. Analysis of Results

The study results were processed based on respondent questionnaire data with 242 respondents. The respondent's answer, according to the weight of each statement item, then calculates the average value of each variable to determine user satisfaction level. The following is to determine the average satisfaction value (ASV) using the Equation for the number of questionnaire scores (NQS) divided by the number of questionnaires (NQ) in Equation 2 of the Kaplan and Norton calculation methods [34].

$$ASV = \frac{NQS}{NQ} \quad (2)$$

The level of user satisfaction is known by the characteristics of the assessment according to the results of the average value of each variable in the PIECES method. Table 5 of the following assessment of satisfaction criteria [2].

Table 5. Assessment Characteristics

| Value | 1 – 1.79 | 1.8 – 2.59 | 2.6 – 3.39 | 3.4 – 4.91 | 4.92 – 5 |
|-----------|-------------------|--------------|------------|------------|----------------|
| Criterion | Very Dissatisfied | Dissatisfied | Neutral | Satisfied | Very Satisfied |

The resulting calculation process of the average value then determines the conclusion of the satisfaction level based on the assessment criteria of each variable of the PIECES method. Then the results of the calculation of respondents' answers for each variable were analyzed by the STS and TS answers to find out which respondents were dissatisfied using the system. Problems found in each variable will be suggested to develop the system. System development recommendations are adjusted to variable indicators with low satisfaction levels [2].

Results and Discussion

A. Results Analysis Based on PIECES Method Variables

This research involves a significantly large number of respondents, 242 participants. This is allowing for more representative overview of user satisfaction. This enables the development of strategies to enhance user satisfaction through system quality improvement. Recapitulation of respondents' answers based on the variables of the PIECES method consisting of performance, information, economy, control, efficiency, and service. Each variable has an indicator on the questionnaire. The number of questionnaire statements has 21 indicators. Table 6 shows the answer results of the library information system respondents.

Table 6. Respondent answer results based on PIECES variable analysis

| Criteria | Value | Performance | | | | | | | Information | | | | | Economy | | |
|----------|-------|-------------|----|----|----|----|----|-------|-------------|----|----|----|-------|---------|----|-------|
| | | A1 | A2 | A3 | A4 | A5 | A6 | Total | B1 | B2 | B3 | B4 | Total | C1 | C2 | Total |
| STS | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 3 | 0 | 5 | 1 | 1 | 2 |

| Criteria | Value | Performance | | | | | | | Information | | | | | Economy | | |
|----------|-------|-------------|-----|-----|-----|-----|-----|-------|-------------|-----|-----|-----|-------|---------|-----|-------|
| | | A1 | A2 | A3 | A4 | A5 | A6 | Total | B1 | B2 | B3 | B4 | Total | C1 | C2 | Total |
| TS | 2 | 4 | 8 | 3 | 5 | 8 | 10 | 38 | 6 | 6 | 8 | 5 | 25 | 8 | 5 | 13 |
| R | 3 | 60 | 72 | 86 | 77 | 99 | 75 | 469 | 78 | 76 | 84 | 55 | 293 | 78 | 74 | 152 |
| S | 4 | 130 | 133 | 112 | 132 | 100 | 129 | 736 | 119 | 121 | 108 | 145 | 493 | 112 | 119 | 231 |
| SS | 5 | 48 | 29 | 41 | 28 | 35 | 28 | 209 | 39 | 37 | 39 | 37 | 152 | 42 | 43 | 85 |

| Criteria | Value | Control | | | | | | Efficiency | | | Service | | |
|----------|-------|---------|-----|-----|-----|-----|-------|------------|-----|-------|---------|-----|-------|
| | | D1 | D2 | D3 | D4 | D5 | Total | E1 | E2 | Total | F1 | F2 | Total |
| STS | 1 | 0 | 0 | 0 | 0 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| TS | 2 | 5 | 4 | 8 | 5 | 17 | 39 | 5 | 8 | 13 | 1 | 2 | 3 |
| R | 3 | 79 | 84 | 64 | 77 | 81 | 385 | 87 | 70 | 157 | 72 | 65 | 137 |
| S | 4 | 116 | 119 | 131 | 122 | 109 | 597 | 110 | 130 | 240 | 125 | 127 | 252 |
| SS | 5 | 42 | 35 | 39 | 38 | 33 | 187 | 40 | 34 | 74 | 44 | 48 | 92 |

1. Performance Variables

Analysis of performance variables is seen from the performance of the system. The indicators used are ease of access, speed, accuracy, and stability of system operation. The following is the analysis result of calculating the average value of the performance variable according to [Table 6](#) using [Equation 2](#).

$$ASV = \frac{(1 \times 0) + (2 \times 38) + (3 \times 469) + (4 \times 736) + (5 \times 209)}{0 + 38 + 469 + 736 + 209}$$

$$ASV = \frac{5472}{1452} = 3.77$$

The calculation of the average value of the Performance variable resulted in a value of 3.77. It was categorized on the satisfied criterion ([Table 5](#)). Satisfaction with the performance variables can be concluded that the system performance is good from the user's perception.

2. Information Variables

Indicators of the information variable are the suitability, the integrity and availability of the data. Calculating the average value of the information variable is based on [Table 6](#) and using [Equation 2](#).

$$ASV = \frac{(1 \times 0) + (2 \times 25) + (3 \times 293) + (4 \times 493) + (5 \times 152)}{0 + 25 + 293 + 493 + 152}$$

$$ASV = \frac{3666}{968} = 3.79$$

The calculation of the average information variable resulted in a value of 3.79, which was included in the Satisfied criterion as in [Table 5](#). It is concluded that the satisfaction of system users based on the information variable is good.

3. Economic Variables

Analysis of economic variable indicators consists of either the implementation of the system can save costs and benefit users instead of using conventional means. The following is the calculation of the average of the economic variables as per [Table 6](#) and using [Equation 2](#).

$$ASV = \frac{(1 \times 2) + (2 \times 13) + (3 \times 152) + (4 \times 231) + (5 \times 85)}{2 + 13 + 152 + 231 + 85}$$

$$ASV = \frac{1833}{483} = 3.80$$

The average of the economic variable generated a value of 3.80, so it is categorized in the satisfied criterion as in [Table 5](#). It is concluded that using systems based on economic variables can work well from user perceptions.

4. Control Variables

The indicators of control variable were maintaining data integrity from various crimes, providing clear authority, good storage management, and minimalizing system input errors. The following is the calculation of the average value of respondents' answers in Control variables according to [Table 6](#) using [Equation 2](#).

$$ASV = \frac{(1 \times 2) + (2 \times 39) + (3 \times 385) + (4 \times 597) + (5 \times 187)}{2 + 39 + 385 + 597 + 187}$$

$$ASV = \frac{4558}{1210} = 3.77$$

The calculation of the average control variable resulted in a value of 3.77, the results of the average values obtained can be concluded the system's quality based on the control variables categorized on the satisfied criterion as in [Table 5](#).

5. Efficiency Variables

Indicators of efficiency variable consist of the system alleviation in terms of cost and time, and the system's operation display according to minimal time and material. The following is the calculation of the average value of the efficiency variable based on [Table 6](#) using [Equation 2](#).

$$ASV = \frac{(1 \times 0) + (2 \times 13) + (3 \times 157) + (4 \times 240) + (5 \times 74)}{0 + 13 + 157 + 240 + 74}$$

$$ASV = \frac{1827}{484} = 3.77$$

The average value of the efficiency variable obtained a value of 3.77, based on the calculation results, it is concluded that system users' satisfaction level from the efficiency variable is categorized in the satisfied criterion as in [Table 5](#).

6. Service Variables

The indicators of service variable analysis were easy-to-operate system and useful system service for users. The following is the calculation of the service variable based on [Table 6](#) using [Equation 2](#).

$$ASV = \frac{(1 \times 0) + (2 \times 3) + (3 \times 137) + (4 \times 252) + (5 \times 92)}{0 + 3 + 137 + 252 + 92}$$

$$ASV = \frac{1885}{484} = 3.89$$

The average service variable generated a value of 3.89, based on the results obtained, it can be concluded that the system's quality is within the satisfied criteria as in [Table 5](#).

The results of the variable satisfaction of the PIECES method in the implementation of the library information system are on the satisfied criteria with an average satisfaction of more than 3.4 – 4.91 as in [Table 5](#). The results of comparing the satisfaction level of each variable of the PIECES method are in [Figure 5](#).

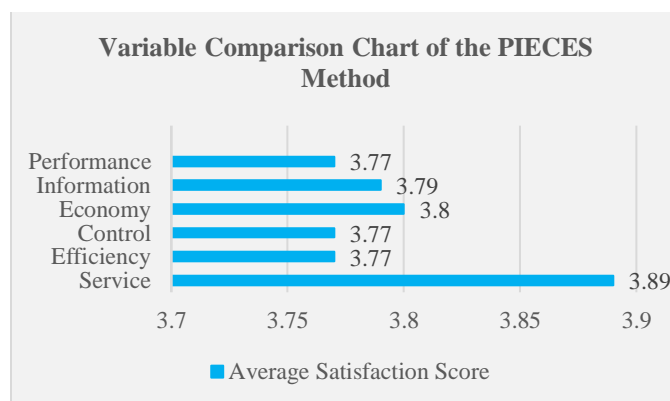


Figure 5. Variable Comparison Chart of the PIECES Method

Based on the results of the comparison chart in [Figure 5](#), which shows the highest level of satisfaction in the service variable within the satisfied criterion, it can be said that the service during the use of the system as per user expectations. The lowest level of satisfaction in the variables of performance, control, and efficiency is 3.77 within

the criteria of satisfied. In general, according to the calculation results of each variable that users are satisfied with the implementation of the IKIP Muhammadiyah Maumere library information system, it can be concluded that it is running well.

B. Analysis of Problem Identification Results and System Improvement Recommendations

The calculation of the number of respondents' dominating answer scores is the agree answer, and the average value of the PIECES method has been obtained based on the variables of performance, information, economy, control, efficiency, and service. Identification of information system problems is viewed based on the answers of respondents who choose the answers STS and TS for each PIECES variable. In [Figure 6](#), the graph identifies library information system problems as per [Table 6](#).

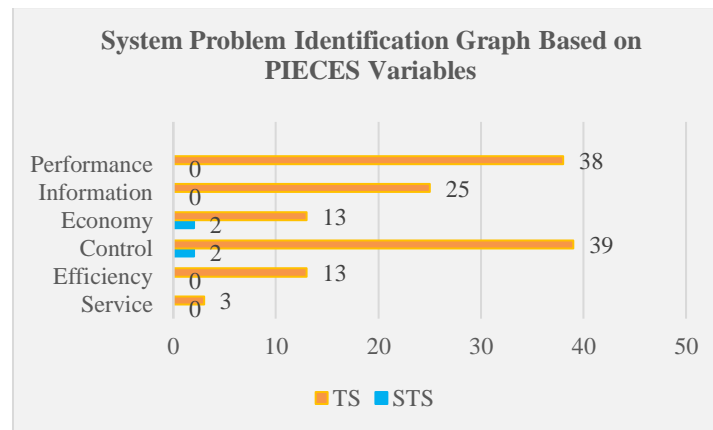


Figure 6. System Problem Identification Graph Based on PIECES Variables

The analysis of the library information system using the PIECES method shows in [Figure 6](#). It explains the respondent's responses, such as STS and TS. The highest on the variable performance were 38 answers TS, Information 25 answers TS, Control 39 answers TS, and 2 answers STS. Knowing the problem as a consideration or recommendation for system development is necessary.

Performance variables are known to be problems found in indicators of system performance stability when it was used simultaneously and the speed and timeliness of the system in processing data into information. Here are several recommendations to improve the library information system regarding performance variable issues: 1) Enhancing the technological infrastructure to improve system stability and speed, 2) reviewing the data processing procedures to enhance the accuracy and timeliness of data conversion into information, 3) optimizing algorithms and program code to enhance system performance, 4) efficiently managing resources to avoid bottlenecks, 5) implementing real-time system performance in monitoring mechanisms, 6) providing training and enhancing the competencies of system operators, 7) conducting comprehensive testing and evaluation of the system before its full implementation. With these solutions, it is expected that the library information system can improve stability, speed, and timeliness in processing data into information. This could provide a better experience for the users.

Problems for information variable are found in the conformity and doubling of system data storage indicators. Here are several recommendations for improving the library information system regarding the issues related to the variable of information problems, specifically in terms of data accuracy and duplication indicators in the storage system. It is suggested firstly to conduct a thorough analysis of data accuracy and implement strict validation mechanisms to prevent unnecessary data duplication, secondly to utilize centralized database technology and advanced data management solutions, thirdly provide training to users and system operators on data integrity and perform regular audits to proactively detect issues. With these solutions, it is expected that the library information system can address the issues of data accuracy and duplication indicators, thereby improving efficiency and the quality of information presented to users.

The control variable issues are found in the access control user authority rights management indicator, and an error occurs during the system's operation. Here are several recommendations for improving the library information system with control variable issues: first is to conduct a thorough review and update of the user authority management mechanism to ensure accurate access control, second is to provide comprehensive training to users and system operators on the proper and secure utilization of user authority, third is to enhance the system's error detection mechanisms and lastly is to regularly monitor them to promptly identify and rectify errors that may arise during system operation. Implementing these solutions is expected to effectively address the control indicator challenges, leading to enhanced system security and performance overall.

In general, this research applies the PIECES method with the expectation of bridging the gap in previous studies concerning this method and making new contributions to the development of an optimal and efficient library information system that enhances user satisfaction. Furthermore, it provides valuable insights into user satisfaction

with library information systems and offers recommendations for achieving an ideal system, thereby improving user experiences.

Conclusion

The results of the satisfaction analysis of the IKIP Muhammadiyah Maumere library information system using the PIECES method indicated the majority answers is S (agree). The calculation of the average value of performance is 3.77; information is 3.79; economic is 3.80; control is 3.77; efficiency is 3.77; and service is 3.89. Based on the obtained results, the average value of all variables are on the satisfied criterion with an average satisfaction of 3.4 – 4.91.

Based on the number of respondent's answers of STS and TS, it was found that the problem with the analysis of pieces variables was performance, information, and control. System improvements are recommended according to the known PIECES variable indicators in the performance variables to improve the system's stability, speed, and accuracy in managing data into information. Information variable improves the suitability of management in system data storage. Control variable improves user access control and reduces the risk of system errors.

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