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Software Quality Analysis using the ISO 25010 Standard on the Digital Information System of the Blitar City Government

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ABSTRAK

Sistem Informasi Kepegawaian Online dan Terintegrasi (SIKOI) dikembangkan oleh Badan Kepegawaian dan Pengembangan Sumber Daya Manusia (BKPSDM) untuk mengelola data administrasi sekitar 3.200 pegawai di Kota Blitar. Sistem ini masih dalam tahap pengembangan, sehingga penelitian ini bertujuan untuk mengevaluasi kualitas aplikasi SIKOI berdasarkan standar ISO/IEC 25010 yang mencakup aspek fungsional dan non-fungsional. Metode yang digunakan mencakup observasi langsung dan studi literatur mengenai standar kualitas perangkat lunak. Evaluasi dilakukan terhadap tujuh karakteristik utama, yaitu *functional suitability, performance efficiency, compatibility, usability, reliability, security,* dan *portability.* Hasil dari penelitian ini memberikan gambaran kualitas sistem dan membantu pengelola dalam menentukan langkah-langkah perbaikan yang tepat. Aplikasi SIKOI dinilai layak digunakan dengan skor Usability mencapai 89,36% dan Functional Suitability tertinggi sebesar 94,15% yang dapat mendukung pengelolaan kepegawaian di Kota Blitar, namun aspek keamanan dan reliabilitas perlu ditingkatkan guna mengoptimalkan kinerja secara menyeluruh.

Keyword
Digital Government Application,
ISO/IEC 25010,
Personnel Information System,
Software Testing,
System Quality

ABSTRACT

The Online and Integrated Personnel Information System (SIKOI) was developed by the Regional Civil Service and Human Resource Development Agency (BKPSDM) to manage the administrative data of approximately 3,200 employees in the City of Blitar. As the system is still under development, this study aims to evaluate the quality of the SIKOI application using the ISO/IEC 25010 standard, which covers both functional and non-functional aspects. The research methods include direct observation and literature review regarding software quality standards. The evaluation was conducted across seven key characteristics: functional suitability, performance efficiency, compatibility, usability, reliability, security, and portability. The results of this study provide insights into the system's quality and assist system managers in formulating appropriate improvement measures. SIKOI is considered sufficiently feasible to support personnel management in Blitar City; however, several aspects still require improvement in order to fully optimize its overall performance.

1. Introduction

The civil service information system plays a vital role in managing employee data and information, especially in the government sector. Previously, management tended to be done manually and was prone to errors. A digital civil service information system makes work more structured and efficient. High-quality information resources support the optimal use of the internet in obtaining necessary information [1]. The IT team at the Agency for Personnel and Human Resources Development (BKPSDM) of the Blitar City Government is currently utilizing information technology to manage personnel administration through a website called SIKOI "Sistem Informasi Kepegawaian Online dan Terpadu." This system aims to facilitate administrative processes for approximately 3,200 employees, simplifying data management without the need for face-to-face interaction.

A website designed for convenience may still face various obstacles that can affect its performance. To ensure website quality, testing is necessary to assess whether the created and developed website aligns with its planning and achieves its objectives [2]. According to Murdiani and Umar [2], previous research by Hakam stated that in the context of information systems, evaluating the quality of a system can be conducted through various methods and at different levels, depending on the evaluation's purpose. These objectives can include assessing the system's technical capabilities, operational effectiveness, and overall system utilization.

One approach used to assess the quality of an information system is by applying the ISO 25010 standard. The National Standardization Agency of Indonesia (BSN) [3] explains that the application of the ISO 25010 standard is relevant for testing the quality of a piece of software. According to Maliki in Pratama [4], the ISO 25010 method is one of the methods that supports the evaluation process in a very specific way. The application of ISO/IEC 25010 is often used in testing to ensure that the developed product has good quality [5]. Dellia et al. in [6] explain that the ISO 25010 model can help researchers or reviewers in assessing software quality in a more focused manner.

ISO/IEC 25010 is part of the Systems and software quality models, which replaces ISO/IEC 9126:2001 [7]. Prof. Azuma, at the software testing conference SOFTEC Malaysia, as quoted in Lamada et al. [8], stated that the change from the ISO 9126 standard to ISO 25010 was made due to rapid development, which necessitated a new, more relevant standard capable of adapting to current software quality evaluation needs. Mulyawan et al. in [9] explain that ISO/IEC 25010 is now widely used to evaluate the quality of various software, including academic information systems, government and private institution information systems, games, mobile applications, and decision support systems. Software quality assessment is carried out by measuring important aspects selected according to the specific needs of each software.

This research focuses on the testing and quality evaluation of “Sistem Informasi Kepegawaian Online dan Terpadu” (SIKOI) application of Blitar City based on the ISO 25010 standard. The problem formulation in this study includes how to determine the results of software testing based on functional and non-functional aspects, and to what extent the software's quality meets the ISO 25010 standard. The objective of this research is to analyze and evaluate the quality of the SIKOI application according to the ISO 25010 framework, as well as to identify the system's strengths and weaknesses as a basis for improvement recommendations. The benefits of this research include contributing to the development of literature in the field of government software evaluation, and providing guidance for the Blitar City Government in enhancing the quality of the SIKOI application more optimally and in accordance with international standards on the scope of application testing.

2. Method

Each stage is designed to ensure an accurate process. The following flow provides a complete overview of the process undertaken.

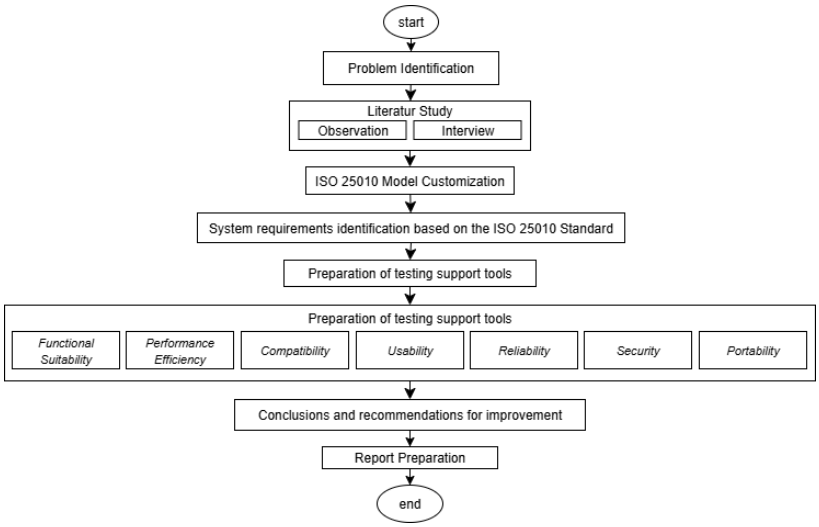

Figure 1. Research Flow

Problem Identification

Problem identification is the step of finding a gap or disparity between the ideal and actual conditions. This gap forms the basis for determining the research focus and developing appropriate questions. In this context, the application is expected to have undergone a testing process. However, based on observation, testing has not been conducted, especially using the ISO 25010 standard. Therefore, the problem is formulated into research questions to guide the analysis steps in order to obtain answers that align with the research objectives.

Literature Study

The literature study in this research comprises two primary sources: a review of previous research and interviews with relevant parties. The review involves examining references such as journals, scientific articles, and official documents that discuss the ISO 25010 software quality standard. Meanwhile, the interviews aim to gather direct information from the administrators of the SIKOI system using a flexible approach, conducted either face-to-face or through media. The results of the interviews are then analyzed in accordance with the research focus.

ISO 25010 Model Customization

In the evaluation process, aspects need to be adjusted to be relevant to the software being studied. In this research, the maintainability aspect was not evaluated because testing for this characteristic is generally conducted by developers or internal teams directly involved in the system's development and maintenance cycle. Nevertheless, the testing can still proceed because the ISO 25010 Standard [3] does not mandate that all aspects must be tested in a single study to declare that an application has good quality.

System Requirements Identification based on the ISO 25010 Standard

Identifying requirements is useful for formulating the quality aspects that the tested application must fulfill. Furthermore, this identification also serves as the basis for developing the evaluation instrument. In this system, identification is carried out by matching it against the quality sub-characteristics of ISO 25010.

Preparation of Testing Support Tools

The preparation of support tools ensures that the testing process yields objective data. In this research, several support tools were used to aid the software quality evaluation process. The following is a list of the tools that were used.

Table 1. Testing Support Tools

Model Category	Support Tools
Functional Suitability, Compatibility, Portability	*Google Spreadsheets*
Performance Efficiency	*Kali Linux (Apache Benchmark, Htop, Siege)*
Usability	*Google Form*
Reliability	*Kali Linux (Wrk, Uptime Kuma, SlowHTTPTest, Gping)*
Security	*Kali Linux (Burp Suite)*

Table 1 shows the testing support tools based on the aspects of the ISO 25010 standard. These support tools are available in Kali Linux and Google Apps.

Testing Implementation and Results Analysis

The testing and analysis of the software's quality were conducted on the three features available in SIKOI: Manajemen Talenta, E-Cuti, and SMEDI. Each aspect has its own distinct testing process designed to comprehensively evaluate the software's quality aspects. The following is an explanation of the testing process based on each of the support tools used.

Google Spreadsheets

The testing for Functional Suitability, Compatibility, and Portability begins by creating a test case document that includes application usage scenarios. After testing, the results are processed to obtain a total score for the software's quality. This calculation uses a formula developed by T. Ghaffur and Nurkhamid, as explained in reference [6] below.

$$Precentage = \frac{ObtainedScore}{MaximumScore} \times 100\% \quad (1)$$

After the results are obtained as a percentage, the next step is to classify the data. The test results are placed into groups according to their level of quality achievement.

Table 2. Test Result Classification [6]

No	Percentage	Category
1	0% - 20%	Highly Unsuitable
2	21% - 40%	Unsuitable
3	41% - 60%	Fair
4	61% - 80%	Suitable
5	81% - 100%	Highly Suitable

Table 2 presents the classification of the feasibility level of the test results into five categories with clear value ranges, where each percentage interval does not overlap. This provides clarity and decisiveness in classifying the test results.

The testing of the compatibility aspect aims to assess whether the system can run smoothly on various browsers. This result ensures that the user experience is not disrupted even when accessed from different browsers. The application was tested on the three most popular or frequently used browsers to see if there were any differences in display or functions that did not work properly. Based on data from Backlinko [11], Google Chrome is the most dominant browser. Safari is in second place, and Microsoft Edge is in third.

The portability aspect tests the system on various devices such as computers, laptops, and tablets. Its purpose is to ensure that the system can run without problems in different technological environments. Testing is conducted manually to observe whether the application remains functional, responsive, and maintains a consistent appearance across various platforms.

Google Form

In usability testing, an assessment is conducted to measure how easily users can interact with the application. According to Efendi et al. [12], previous research by Nielsen stated that testing can be performed with a minimum of 20 respondents to obtain more accurate and convincing results. With this number, the test results are expected to provide a more representative overview.

Table 3. J.R. Lewis Questionnaire [22]

No	Questions
1	This system provides all the functions.
2	Overall, I am very satisfied with the application's performance.
3	If an error occurs, the application provides a message about the steps I can take to resolve it.
4	I can quickly correct errors when using the application.
5	Overall, I am satisfied with using the application.
6	I find it very simple to use.
7	I can quickly correct errors when using the application.
8	I can effectively complete my work using the application.
9	I can efficiently complete my work using the application.
10	I believe I am more productive when using the application.
11	The application is easy to learn.
12	The application makes it easy to find the information I need.
13	The application's layout on the screen is very clear.
14	The application's display is very user-friendly.
15	I like using this type of display.
16	The information provided by the application is easy to understand.
17	The information provided is very effective in helping me complete my work.
18	The information provided is very clear.
19	I feel comfortable using the application.

Table 3 presents 19 test questions covering the usability sub-aspect of the ISO 25010 standard. According to Asmara in [13], the method by J.R. Lewis was chosen because it is periodically tested and widely used.

$$Sc \vee e_{total} = (V_{hu} \times 1) + (V_u \times 2) + (V_f \times 3) + (V_s \times 4) + (V_{hs} \times 5) \quad (2)$$

Description:
V_{hu}: High Unsuitable Value
V_u: Unsuitable Value
V_f: Fair Value
V_s: Suitable Value
V_{hs}: High Suitable Value

The formula above is needed to obtain the total score from the questionnaire results. The next calculation is performed to get the percentage of the total test score by using the following formula.

$$Precentage = \frac{\sum score}{i \times r \times 5} \times 100\% \quad (3)$$

Description:
∑score: Total score test
i: number of question items
r: number of respondents or test subjects

The percentage that has been obtained is converted based on the categories that have been classified in Table 2.

Kali Linux

Testing for the Performance Efficiency, Reliability, and Security aspects utilizes the support tools listed in Table 2, which are available in the Kali Linux operating system [10]. The Security aspect focuses on Man-in-the-Middle (MITM) attacks using Burp Suite. An MITM attack allows an attacker to position themselves in the middle of a communication, freely viewing and altering its content, which can lead to data breaches [14]. Agustina et al. in [15] state that Burp Suite is used to test the security of web applications, with features capable of detecting and exploiting existing vulnerabilities. Burp Suite has become a standard for testing and strengthening web application security.

Table 4. Testing Target

Aspect	Testing Target
Performance Efficiency	The overall response time is no more than 3 seconds.
	Resource usage is within safe limits (does not exceed available capacity).
	The server handles the load and does not bottleneck under peak load.
Reliability	The system is mature, consistently handling an average of 20 requests per second.
	There are no connection errors, data reads, writes, or timeouts.
	Service availability is maintained without the potential for repeated downtime.
	Service stability is maintained even in the face of attacks.
	Connection stability is maintained, indicated by infrequent and low latency.
Security	Ensures sensitive data cannot be spied on by third parties.
	Ensures data cannot be manipulated by users.
	Ensures that users cannot deny having performed certain actions.
	Ensures that every user action can be accurately identified with a legitimate identity.
	Ensures that only valid users can access the service.

Table 4 presents the target points for testing, which correspond to the needs of the SIKOI system and were obtained through an interview with a source. These testing targets are used to analyze whether the system has fulfilled the aspects of the ISO 25010 standard.

Conclusions and Recommendation for Improvements

The results from the various tests are analyzed to summarize the findings regarding the software's quality based on the ISO/IEC 25010 standard. The analysis determines the extent to which the system meets the quality standards and is used to formulate improvement recommendations to enhance it so that it can continue to function properly.

Report Preparation

Report preparation is the final stage of the research and software evaluation. The report presents all the results, which include an explanation of the process, the findings that were obtained, the conclusions that were drawn, and the improvement recommendations.

3. Result and Analysis

The test results and analysis provide an objective overview of the feasibility of the tested system, presented as follows.

Functional Suitability

Table 5. Functional Suitability Result

Feature	Number of tests	Passed	Failed	Not Tested	Percentage Result	Category
Manajemen Talenta	154	145	8	1	94,15%	Highly Suitable
E-Cuti	46	37	7	2	80,43%	Suitable
SMEDI	42	29	1	12	69,04%	Suitable

Based on Table 5, *Manajemen Talenta*, with a result of 94%, indicates that the feature is able to adapt well. E-Cuti, with a score of 80%, shows that most of its functions are running according to user needs, although there is still room for improvement. SMEDI, with a score of 69%, indicates that some of its functionality runs according to user needs, though there are still functions that need to be optimized. Therefore, further evaluation and refinement can be conducted so that the level of functional suitability increases and can reach the "highly feasible" category in subsequent testing.

Performance Efficiency

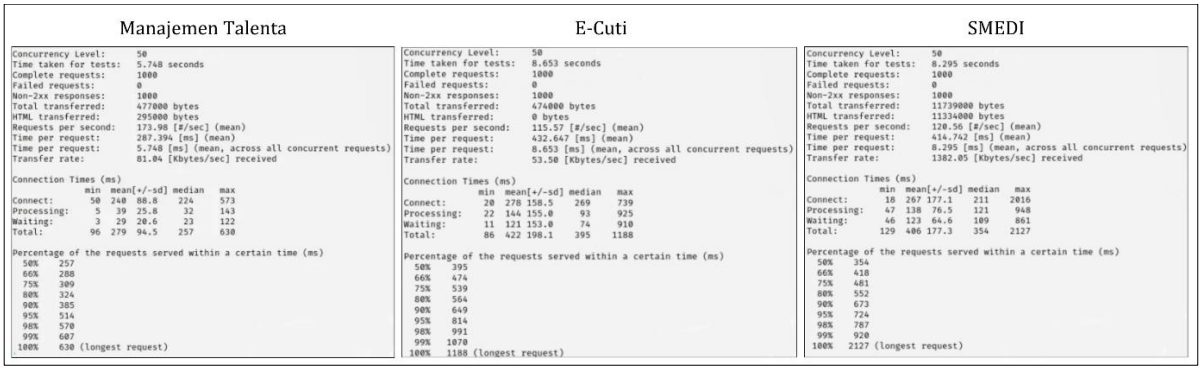

Figure 2. Time Behaviour

Figure 2. shows the results of the Time Behaviour test on the three SIKOI features using Apache Benchmark from Kali Linux. *Manajemen Talenta* shows a completion time for 1000 requests of 5.748 seconds (average of 0.29 seconds/request), E-Cuti took 8.653 seconds (average of 0.43 seconds/request), and SMEDI took 8.295 seconds (average of 0.41 seconds/request). All requests were completed under the 3-second response time standard, thus meeting the requirements.

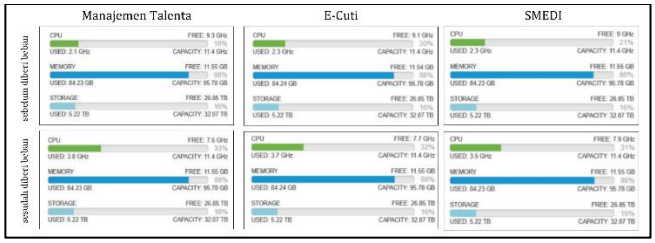

Figure 3. Resource Utilization

Figure 3. shows the difference in the server before and after being loaded using Kali Linux. After being loaded, the CPU for *Manajemen Talenta* increased from 2.1 GHz to 3.8 GHz (about 33%), E-Cuti increased from 2.3 GHz to 3.7 GHz (about 33%), and SMEDI increased from 2.3 GHz to 3.5 GHz (about 31%), indicating an increase in activity. However, memory and storage usage remained the same, showing that the workload had a greater impact on the CPU. It was concluded that the system meets the necessary resource requirements. Although there was an increase in

CPU usage, it remained far from capacity. Memory and storage usage did not experience a spike, indicating that the system has room to handle additional activity.

Manajemen Talenta

```
Lifting the server siege ...
Transactions:                   2059 hits
Availability:                  85.97 %
Elapsed time:                  60.68 secs
Data transferred:               5.51 MB
Response time:                  3.20 secs
Transaction rate:              33.93 trans/sec
Throughput:                     0.09 MB/sec
Concurrency:                  108.58
Successful transactions:        2708
Failed transactions:             336
Longest transaction:           16.49
Shortest transaction:           0.28
```

E-Cuti

```
Lifting the server siege ...
Transactions:                   2921 hits
Availability:                 100.00 %
Elapsed time:                  60.68 secs
Data transferred:              15.18 MB
Response time:                  1.65 secs
Transaction rate:              48.14 trans/sec
Throughput:                     0.25 MB/sec
Concurrency:                   79.66
Successful transactions:        2955
Failed transactions:               0
Longest transaction:           10.86
Shortest transaction:           0.18
```

SMEDI

```
Lifting the server siege ...
Transactions:                     24 hits
Availability:                  12.57 %
Elapsed time:                  61.05 secs
Data transferred:               0.08 MB
Response time:                100.54 secs
Transaction rate:               0.39 trans/sec
Throughput:                     0.00 MB/sec
Concurrency:                   39.53
Successful transactions:         622
Failed transactions:             167
Longest transaction:           25.79
Shortest transaction:           0.28
```

Figure 4. Capacity

Figure 4. shows the results of the Capacity test on the three SIKOI features using Siege from Kali Linux. *Manajemen Talenta* does not yet meet the requirements because its average response time is 3.20 seconds/request, with the longest transaction reaching 16.49 seconds, which indicates a bottleneck when the system is under peak load. E-Cuti has met the requirements by showing fairly good performance. SMEDI does not yet meet the requirements because its average response time is very high, reaching 100.54 seconds per request, with the longest transaction recorded at 25.79 seconds. This indicates that the system is not yet able to maintain service availability.

Compatibility

Table 6. Compatibility Result

Feature	Number of tests	Passed	Failed	Not Tested	Percentage Result	Category
Manajemen Talenta	189	188	1	0	99,94%	Highly Suitable
E-Cuti	51	51	0	0	100%	Highly Suitable
SMEDI	63	45	0	18	71,42%	Suitable

According to Table 6, *Manajemen Talenta* and E-Cuti have a good level of compatibility across various browser environments. Thus, the application can run optimally without issues. A high level of compatibility means the application can perform optimally. SMEDI has an adequate level of compatibility, although further adjustments are needed to improve its consistency in different software environments, thereby providing a more optimal user experience.

Usability

Table 7. Usability Result

Description	Total
Number of Questions	19
Number of Respondents	20
Number of Highly Unsuitable Answers	0
Number of Unsuitable Answers	24
Number of Fair Answers	7
Number of Suitable Answers	116
Number of Highly Suitable Answers	233

Table 7 is the recapitulation of the test results for all features. Based on these details, a calculation was then performed using Formula 2, with a resulting total score of 1698. After the total score was obtained, the percentage of the test results was calculated using Formula 3, yielding a percentage of 89.36%, which indicates that the system is in the highly feasible category for use.

Reliability

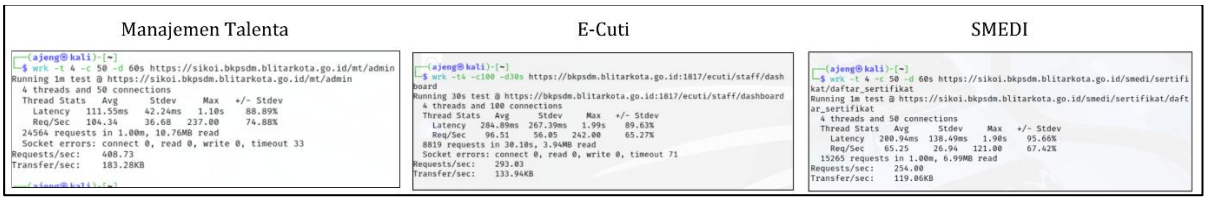

Figure 5. Maturity

Figure 5 shows the results of the Maturity test on the three SIKOI features using wrk on Kali Linux. *Manajemen Talenta* has met the requirements, demonstrated by its ability to consistently handle an average of 408.73 requests/second. Furthermore, there were no connection, read, or write errors, indicating that the system is sufficiently mature. E-Cuti has met the requirements, as it was able to handle an average of 293.03 requests/second. During the 30-second test, a total of 8,819 requests were successfully completed, transferring a total of 3.94 MB of data, with no connection, read, or write errors. However, there were 71 requests that timed out, indicating a need for improvement in handling high loads. SMEDI has met the requirements, as it was able to handle an average of approximately 254.00 transactions per second.

Figure 6. Availability

Figure 6. shows the results of the Availability test on the three SIKOI features using Uptime Kuma on Kali Linux. The data indicates that the service has an availability level (uptime) of 91.58% over the last 24 hours and 30 days, which means there has been downtime. The response time fluctuated quite significantly and has previously reached higher peaks. From the availability aspect, this system does not yet meet the requirements because potential recurring downtime could impact service delivery, thus system improvements are still necessary.

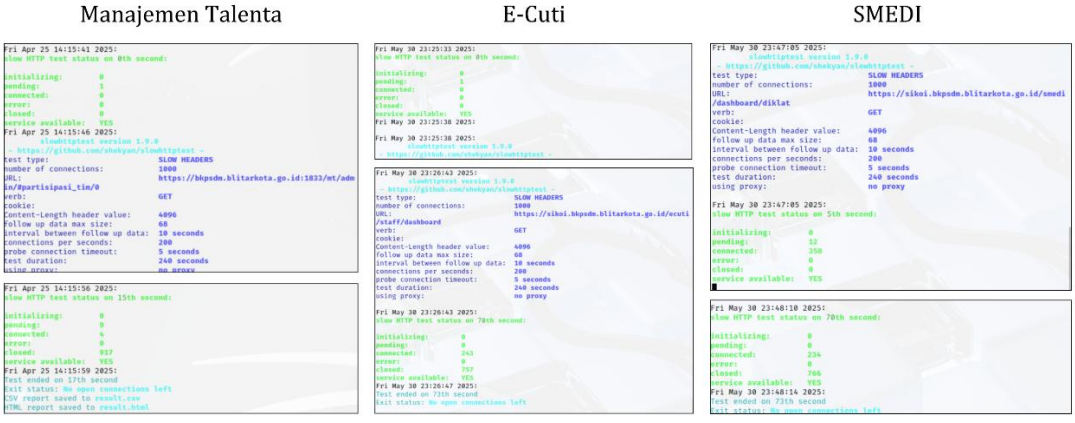

Figure 7. Fault Tolerance

Figure 7. is the result of Fault Tolerance testing of the three SIKOI features using SlowHTTPTest Kali Linux with the Slow Headers method. *Manajemen Talenta* showed good resilience, although the test tool was configured to run 240 seconds with a target of 1000 connections, the test ended in 17 seconds because there were no more connections that could be kept open by the attacker. E-Cuti also met the requirement as the test stopped sooner at 73 seconds and SMEDI at 73 seconds as there were no more open connections left. Most of the connections, 766, were actively closed by the server, while only 234 connections were able to connect successfully. Despite this, the service was still detected as available throughout the testing process, indicating the server identified and terminated slow connections efficiently. This quick response indicates an effective protection mechanism against Slow HTTP attacks, so the system can be said to remain stable and not experience any significant service interruptions. The server actively closed most of the connections it attempted to open slowly, preventing the test tool from consuming server resources by keeping many connections hanging.

Figure 8. Recoverability

Figure 8. is the result of Recoverability testing of the three SIKOI features using Gping Kali Linux. Gping results show that the connection is generally active with a fairly good basic latency, ranging from 40-70ms and averaging around 53.6ms. Nonetheless, the system does not meet the requirements and needs improvement as the graphical analysis shows that there is significant connection instability, characterized by frequent and high latency spikes, reaching a maximum value of around 191ms. From the recoverability aspect, these spikes indicate that although the server responds quickly most of the time, there are periods where the response time increases dramatically.

Security

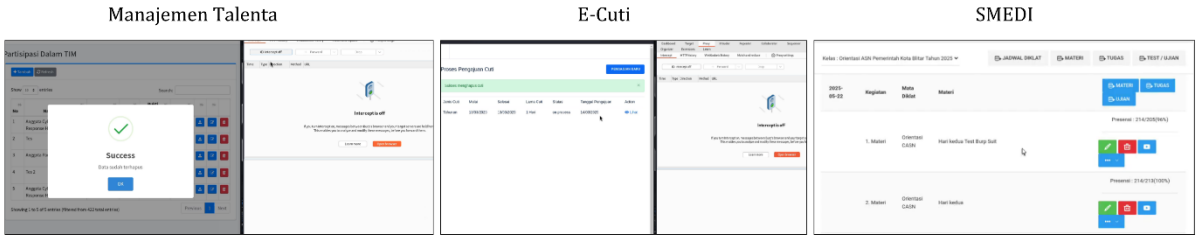

Figure 9. Security

Figure 9 shows the results of the Man-in-the-Middle (MITM) Attack test on the three SIKOI features using Burp Suite from Kali Linux. From the test results, it was found that all features do not yet meet the overall aspects of Security. This includes Confidentiality, which indicates that data can be read directly by third parties; Integrity, as there is no data verification on the server, thus allowing manipulation of the transmitted content; Non-repudiation, as there is no identifying proof of modification actions; Accountability, as the system cannot show logs or user identity

when data is altered; and Authenticity, as modified requests are still accepted by the server. These test results show that all features still have security vulnerabilities; therefore, a comprehensive strengthening of the security aspect is required to make the application more secure.

Portability

Table 8. Portability Result

Feature	Number of tests	Passed	Failed	Not Tested	Percentage Result	Category
Manajemen Talenta	51	51	0	0	100%	Highly Suitable
E-Cuti	60	60	0	0	100%	Highly Suitable
SMEDI	81	63	0	18	77,77%	Suitable

Based on Table 8, Manajemen Talenta and E-Cuti have a very good level of portability across various devices, with a percentage of 100%. This achievement shows that the application has excellent portability, allowing it to be accessed smoothly on various types of devices without significant obstacles for the user. SMEDI is in the feasible category, having adapted well to most of the devices used in testing, such as computers, tablets, and smartphones.

4. Conclusion

This research was conducted to test the quality of the information system in the Blitar City Government. Based on the test results, it was found that the information system used has shown relatively good performance, particularly in Usability, which achieved a score of 89.36% , as well as Compatibility and Portability, where certain features reached a perfect 100%. However, the system does not yet fully meet the ISO 25010 standard due to critical weaknesses in the Security aspect, which failed to handle Man-in-the-Middle (MITM) attacks, and the Reliability aspect, which recorded an availability level (uptime) of only 91.58% with indications of downtime. The findings of this research have surpassed those of previous research by Murdiani (2020), which only tested four characteristics of ISO 25010. The advantage of this study lies in its testing of all characteristics within ISO 25010, which can provide a prospect for future research to further analyze the causes of stability issues and design new, more robust security features for the information system.

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