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Evaluating Software Quality in a Point of Sales System in a Fast-Food Restaurant Using the McCall Model

Wahyu Fidi Ramadhina Assidiq*[1], Fidi Wincoko Putro[2], Arni Muarifah Amri[3]

[1,2,3]Software Engineering, Surabaya Campus, Telkom University, Indonesia

Email: [1]fidiramadhina@student.telkomuniversity.ac.id

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Abstract

Software quality is an critical aspect in ensuring system performance and user satisfaction. This study evaluates the quality of the system called Sampos. is a system used by internal employees in managing fast food business operations for record transactions. manage raw material stocks and help track daily reports. The evaluation was conducted using the McCall model, which focuses on five primary quality factors: correctness, reliability, efficiency, integrity, and usability. Each factor is assessed through indicators that reflect the system's performance in that aspect. The measurement stage begins by assigning weights to each indicator based on its level of importance. Then. The quality value of each factor is calculated to get a comprehensive picture of system performance. The results of the evaluation showed that the correctness value was 56.2%, reliability 56%, Integrity 47.8%, and usability 46%, which are generally classified as "Pretty Good.". Meanwhile, the value of the efficiency factor is only 38.2%, so it is categorized as "not good." Overall, the Sampos system obtained an average score of 41% - 60%. This indicates that the system requires improvement, especially in the aspect of efficiency. This study contributes to proving that McCall's method can be used to evaluate applications built without documentation and by a single developer. Therefore, this study contributes a practical case study on the application of McCall's Model as an effective method for identifying and quantifying quality weakness in small-scale operational systems.

Keywords: *McCall Model, Point of Sales (POS), Product Operation, Software Quality*

1. INTRODUCTION

Software engineering plays a crucial role in increasing productivity and minimizing operational errors today. In today's digital age, reliable software not only streamlines workflows but also serves as a vital component for achieving organizational objectives. Prioritizing software quality is critical because it directly impacts user satisfaction levels and the success of system integration efforts [1], [2] in that context. A study in the banking sector in Indonesia also demonstrates that system quality is a significant factor affecting user satisfaction with accounting information systems [3]. Software quality management focuses on efforts to ensure that the developed system meets the set goals. Fundamentally, the level of functionality of a system is determined by its ability to respond to user needs and show efficient and reliable performance during its operational process [4]. Nevertheless. Despite the importance of this. The quality aspect is often overlooked in software development practices. Thus, causing technical problems that hinder business processes [5]. Therefore. A systematic approach to evaluating and measuring software quality is essential for assessing the system's feasibility and laying the groundwork for continuous quality improvement [6]. However, the value of the evaluation will increase if it can inform the quality improvement plan directly. Therefore, a mechanism is needed to generate actionable guidance from quality data to help practitioners make better decisions and prevent future defects [7].

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To address the need for such practical evaluation, this research conducted a case study on The Sampos System, an internal management system used by XYZ companies. A business engaged in the food sector that has more than 10 outlets. This system has been operational for approximately one year, supporting daily operational activities across all outlets. However, a challenge arose. Although it has been actively used, there has never been a structured evaluation of the quality of the Sampos system to date. Along with the high intensity of use, end-users began to give various responses regarding their experience when interacting with the system, such as perceptions of performance, reliability, and ease of use. This indicates that there is an urgent need to conduct a quality evaluation from the end user's perspective. To obtain an objective assessment of the system's quality based on user experience, an appropriate evaluation approach is necessary. The McCall model was chosen because it offers a simple and easy-to-implement framework. However, it still covers important aspects of software quality assessment [8].

The choice of this model was also based on a comparison with other evaluation work. For comparison, models such as the ISO/IEC 9126 model have several drawbacks that make it less appropriate to apply directly. Ambiguity in describing its characteristics and sub-characteristics can lead to differences in interpretation during the evaluation process, which may affect the consistency of measurement results. It also makes it difficult to thoroughly interpret the evaluation results. Because this model is considered too common. Additional adjustments are often required to be effectively applied to a wide variety of system conditions [9]. ISO/IEC 25010 is a development of ISO/IEC 9126, incorporating improvements in the definition aspect. Characteristics and the addition of a more contextual quality dimension [10]. While this model offers a broader and structured scope of assessment, its implementation requires complete system documentation as well as a well-documented development process [11]. Given that a single developer developed the Sampos system without adequate documentation support and limited access to the source code, this model is considered less suitable for evaluating software quality in this study.

Considering resource limitations. Lack of documentation, as well as research focus on operational quality aspects. Hence, the McCall model was chosen as the appropriate approach. The challenge of implementing software quality assurance comprehensively, particularly in relation to documentation and resources, is often encountered in the context of small-scale development or startup companies, which necessitates a more pragmatic approach [12]. This model can provide a comprehensive assessment of operational quality without requiring in-depth technical information, such as system documentation. The McCall model groups software quality into three main aspects, namely operational characteristics. The ability to experience change and the ability to adapt to a new environment [13]. These three aspects encompass 11 factors, which are categorized into product revision, product transition, and product operation [14]. The novelty of this research lies in the application of McCall's model to evaluate the quality of Point of Sales (POS) systems developed by a single developer and without documentation. This scenario is common but rarely evaluated academically.

In this study. The assessment focuses on the product operation category, which encompasses factors such as correctness, reliability, efficiency, integrity, and usability, as this category is considered the most relevant in measuring system quality from the end user's perspective. This study aims to evaluate the quality of Sampos system software based on the product operation category of the McCall model, to obtain an objective picture from the user's perspective. User satisfaction itself has long been considered a measure of the success of an information system. System quality, which includes aspects such as ease of use, reliability, and response time, as well as information quality, has consistently been identified as a key factor affecting satisfaction [15].

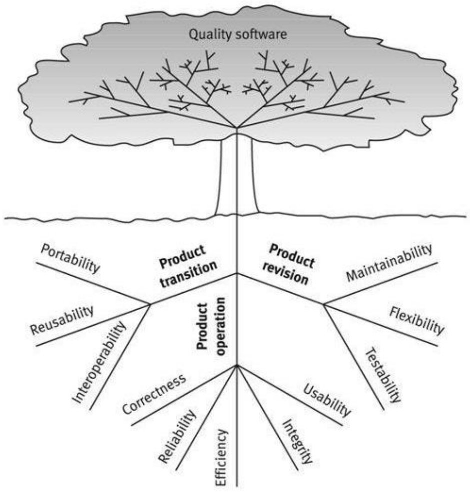

Figure 1. McCall Model

This approach to evaluating quality from an end-user perspective using McCall's model is in line with many previous studies that have applied it to various systems. A few previous studies have also conducted software quality measurements using the McCall model in this category, including research on the Electronic Customer Relationship Management system, where the evaluation results showed an overall value of 53.4%, which falls within the category of quite good [16]. The McCall model has also been applied in measuring software quality in the ticketing system; the results of this study indicate a value of 80.56%, which is categorized as good. Based on these results, the recommendation given is to continue developing features to improve the user's experience. However, the quality of the system is stated to be good [17]. In another study, which measured the quality of software on school websites using the McCall model, a score of 54.4% was obtained, categorized as quite good [18].

The McCall model was also applied to measure the quality of the real-world lecture portal system at one of the universities. The results of this study indicate values of 99.90% for the efficiency factor, 64% for the usability factor, 43% for the reliability factor, 49% for the correctness factor, and 56% for the integrity factor. Based on these values, this system can be categorized as good [19]. Additionally, the McCall model, which is also used in the product operation category, is employed to assess the quality of the Hajj information system through the McCall model approach. The results of this study show that the quality value of the Hajj information system is 41%, which is categorized as quite quality [20].

2. METHOD

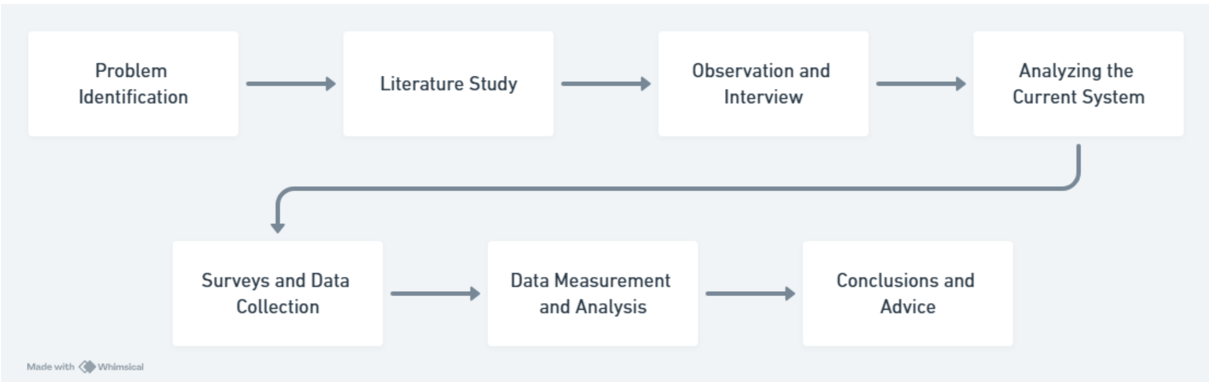

Figure 2. Research Stages

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Figure 2 above illustrates the stages of the research methodology carried out systematically, from the initial stage to the final stage. The first stage is problem identification and preliminary study. At this stage, discussions were held with the owner of XYZ company and the Sampos system developer to gain a thorough understanding of the system and the technical problems that often arise. Furthermore, a literature study was conducted to select the appropriate evaluation model, where the McCall model was chosen because its framework, which focuses on the operational aspects of software from a product operation perspective, is considered the most relevant. The second stage was factor determination and instrument development. Five factors from the product operation category, namely correctness, reliability, efficacy, integrity, and usability, were determined based on discussions with relevant parties. Each factor was then operationally defined through sub-characteristics that were specific and relevant to the context of the Sampos system. These indicators became the basis for the questionnaire.

Correctness is evaluated through indicators such as completeness and consistency of application features, as well as data tracking capabilities across business processes. Reliability was chosen because of the importance of data accuracy and the ability of the system to stay running despite inconsistencies. Integrity includes access control and security, such as the ability for users to access features in their role and the security of the login process. Efficiency measures the efficiency of system execution and the clarity of service display, including application response time and suitability of the data presented. Meanwhile, usability was chosen to assess ease of use, training effectiveness, clarity of system communication, and the simplicity and informativeness of the interface design.

The third stage was data collection and analysis. Observations preceded the questionnaire development process, and interviews were conducted with users, the results of which were used as the basis for the preparation of the questionnaire. Furthermore, an analysis of the Sampos system is carried out, including the main features that support business operations and user access rights. The next stage is the distribution of questionnaires to active users to collect data based on user perceptions and experiences, using a five-point Likert scale based on five factors in the product operation category in the McCall model. The collected data was then analyzed by calculating the mean value and weight of each sub-characteristic using a formula adapted from previous research. The results of the analysis are used as a basis for drawing conclusions and providing suggestions for improvements to the system.

2.1. Data Collection Methods

Data collection was carried out by distributing questionnaires to active users of the Sampos system, which plays a direct role in daily operations. The purpose of this deployment is to obtain data on their perceptions and experiences while using the system. Respondents were asked to answer questions based on five quality factors in the product operation category of the McCall model, using a 5-point Likert scale ranging from "strongly disagree" to "strongly agree" [21].

2.2. Research Questionnaire

The research questionnaire was compiled based on McCall's approach and consisted of 25 questions. Each question is grouped according to the sub-characteristics used in the study. Each sub-characteristic is represented by several questions that are structured to measure specific aspects of the system's quality. Each questionnaire question refers to a previous research reference [16], [17], [22], [23], [24]. Details of the questions are presented in Table 1. The weight of each sub-characteristic is determined to reflect its level of priority in relation to software quality. On a scale between 0.1 (very unimportant) to 0.4 (very important).

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Table 1. Questionnaire Instruments

Factor	Sub-Characteristic	Question	Weight
Correctness	Completeness	Can the application do data processing properly?	0.4
		Do all in-app features work optimally?	0.4
	Consistency	Is the use of language consistent across pages?	0.3
		Does the app have a consistent design across all pages?	0.3
	Traceability	Can the app perform a data search on all systems?	0.4
		Is the app capable of detecting user errors?	0.4
Reliability	Accuracy	Can users access information quickly?	0.4
		Can the app display relevant information?	0.4
	Error Tolerance	Can the app operate again after an error?	0.4
		If there is an error, does the app provide a notification?	0.4
Efficiency	Conciseness	In-app language easy to understand?	0.3
	Execution Efficiency	Do apps display information in an efficient way?	0.4
		Are all features and services tailored to your needs?	0.4
	Operability	Is the information on the application easy to get and understand?	0.3
Integrity	Access Control	Can apps set user permissions?	0.4
		Can users access applications according to access rights?	0.4
	Security	Can the login process work properly?	0.4
Usability	Operability	Are apps easy to use?	0.3
		Are the features and information on the app easy to understand?	0.3
		Do apps provide satisfaction and convenience?	0.3
	Training	Is there a guide/help that helps users?	0.3
		The app gives clear notifications when there is an error and how to fix it.	0.3
		Does the app provide usage documentation information?	0.3
	Communi-cativeness	Availability of contactable contacts on the app?	0.3
	Simplicity	The app has an attractive, well-organized, and simple design.	0.3

2.3. Data Calculation

After determining the measurement factors, the data calculation process is carried out through the following stages**:** [19], [24], [25], [26]. Determination of weights (w) for each criterion first. With a value range between 0 to 1. This weight is determined based on the level of importance of each criterion. Where 0.1 indicates very unimportant and 0.4 indicates very important. The determination of the weight is carried out by the XYZ company. The value of criterion (c) is calculated by summing up all respondents' answers and then dividing by the total number of respondents.

The next step is to calculate the value factor of each sub-characteristic. This value is obtained by adding the result of the multiplication between the weights and the value of the criteria of each sub-characteristic according to the following equation (1):

$$Fa = w1c1 + w2c2 + w3c3 + \cdots + wncn \qquad (1)$$

In the formula, Fa expresses the value factor of the sub-characteristics. w is the weight of each sub-characteristic. Moreover, C is the criterion value based on the average of the respondents' answers. Next. The value of the obtained factor is converted into a percentage according to the following equation (2)

$$Presentase = \frac{Nilai\ yang\ didapat}{Nilai\ maksimum} \times 100\% \qquad (2)$$

The value of the calculation results is then grouped into quality levels according to the percentage obtained from each category. Table 2 shows five levels of quality determined based on the percentage range resulting from the calculation process.

Table 2. Quality Level

Category	Presents
Excellent	81% - 100%
Good	61% - 81%
Pretty Good	41% - 60%
Bad	21% - 40%
Very Bad	<20%

2.4. Conclusions and Recommendations

At this stage is the final process of data analysis, where the results of the evaluation that have been obtained are compared with the problems found in the Sambos system. Based on this analysis. Several recommendations were prepared that aim to improve the quality and effectiveness of the system to better suit user needs and support smooth business operations.

3. RESULT

This section presents the results of the analysis and discussion based on the measurement process that has been carried out for each category to the stage of formulating recommendations. Focus evaluation refers to the aspect of product operation, which includes five main indicators, namely. Correctness. Reliability. Integrity. Efficiency and Usability.

Table 1 shows the results of the questionnaire data processing that has been collected. The values in the table are the basis for the enumeration of each sub-characteristic of each McCall factor. The explanation of this will be described as follows:

3.1. Hasil Perhitungan Kuesioner

After obtaining the average value of each sub-characteristic, the next step is to do calculations to find out the quality value of each factor. This process aims to assess the extent to which each factor has been met based on the average value of each question as well as the weight of its priorities. The following calculations are carried out separately for each factor.

3.1.1. Correctness

After all, the results of the calculation between the weights and criteria for each sub-characteristic are obtained. The next stage is to calculate the value factor by adding up the total results.

$$Fa = \frac{Completeness + Consistency + Traceability}{3} \qquad (3)$$

$$Fa = \frac{3.04 + 2.55 + 2.86}{3}$$

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$$Fa = \frac{8.45}{3}$$

$$Fa = 2.81$$

After getting the Fa value, the next step is to convert the value into a percentage.

$$Presentase = \frac{Nilai\ yang\ didapat}{NIlai\ maksimum} \times 100\% \quad (4)$$

$$Presentase = \frac{2.81}{5} \times 100\%$$

$$Presentase = 56.2\%$$

Table 3. Questionnaire Calculation Results

Factor	Sub-Characteristics	Question Code	Weight	Criterion
Correctness	Completeness	C1	0.4	3.77
		C2	0.4	3.85
	Consistency	C3	0.3	4.32
		C4	0.3	4.2
	Traceability	C5	0.4	3.8
		C6	0.4	3.37
Reliability	Accuracy	C7	0.4	3.27
		C8	0.4	3.97
	Error Tolerance	C9	0.4	3.62
		C10	0.4	3.2
Efficiency	Conciseness	C11	0.3	4.55
	Execution Efficiency	C12	0.4	3.67
		C13	0.4	4.12
	Operability	C14	0.3	4.25
Integrity	Access Control	C15	0.4	3.85
		C16	0.4	4.02
	Security	C17	0.4	4.1
Usability	Operability	C18	0.3	3.9
		C19	0.3	4.35
		C20	0.3	3.95
	Training	C21	0.3	3.82
		C22	0.3	3.22
		C23	0.3	3.57
	Communicativeness	C24	0.3	3.62
	Simplicity	C25	0.3	3.92

3.1.2. Reliability

After all, the results of the calculation between the weights and criteria for each sub-characteristic are obtained. The next stage is to calculate the value factor by adding up the total results.

$$Fa = \frac{Accuracy + Error\ Tolerance}{2} \quad (5)$$

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$$Fa = \frac{2.88+2.72}{2}$$

$$Fa = \frac{5.6}{2}$$

$$Fa = 2.8$$

After getting the Fa value, the next step is to convert the value into a percentage.

$$Presentase = \frac{Nilai\ yang\ didapat}{NIlai\ maksimum} \times 100\% \quad (6)$$

$$Presentase = \frac{2.8}{5} \times 100\%$$

$$Presentase = 56\%$$

3.1.3. Efficiency

After all the results of the calculation of the weights and criteria for each sub-characteristic are obtained, the next stage is to calculate the value factor by adding up the total results.

$$Fa = \frac{Conciseness+Execution\ Efficiency+Operability}{3} \quad (7)$$

$$Fa = \frac{1.36+3.1+1.27}{3}$$

$$Fa = \frac{5.73}{3}$$

$$Fa = 1.91$$

After getting the Fa value, the next step is to convert the value into a percentage.

$$Presentase = \frac{Nilai\ yang\ didapat}{NIlai\ maksimum} \times 100\% \quad (8)$$

$$Presentase = \frac{1.91}{5} \times 100\%$$

$$Presentase = 38.2\%$$

3.1.4. Integrity

After all, the results of the calculation between the weights and criteria for each sub-characteristic are obtained. The next stage is to calculate the value factor by adding up the total results.

$$Fa = \frac{Access\ Control+Security}{2} \quad (9)$$

$$Fa = \frac{3.14+1.64}{2}$$

$$Fa = \frac{4.78}{2}$$

$$Fa = 2.39$$

After getting the Fa value, the next step is to convert the value into a percentage.

$$Presentase = \frac{Nilai\ yang\ didapat}{NIlai\ maksimum} \times 100\% \quad (10)$$

$$Presentase = \frac{2.39}{5} \times 100\%$$

$$Presentase = 47.8\%$$

3.1.5. Usability

After all, the results of the calculation between the weights and criteria for each sub-characteristic are obtained. The next stage is to calculate the value factor by adding up the total results.

$$Fa = \frac{Operability + Training + Communicativeness + Simplicity}{4} \quad (11)$$

$$Fa = \frac{3.65 + 3.43 + 1.08 + 1.17}{4}$$

$$Fa = \frac{9.33}{4}$$

$$Fa = 2.33$$

After getting the Fa grade. Next is to convert the value into a percentage

$$Presentase = \frac{Nilai\ yang\ didapat}{NIlai\ maksimum} \times 100\% \quad (12)$$

$$Presentase = \frac{2.33}{5} \times 100\%$$

$$Presentase = 46.6\%$$

3.2. McCall Analysis

The details of the results of the Sampos system quality evaluation are compiled into a table that represents the percentage of achievement based on each software quality factor. The following table presents the level of system quality according to the results of the calculations that have been carried out.

Based on the results of data processing in Table 4, the correctness factor is 56.2% which is included in the “Good enough” category. This indicates that the Sampos system is able to carry out its functions according to the specified needs and specifications. Although there is still room for improvement in the aspect of functional accuracy. The highest value in correctness is found in the consistency sub-characteristic, which indicates that the appearance and structure of the page is considered quite consistent by users. However, the completeness score is still relatively low, indicating that some features do not fully support comprehensive data management, resulting in incomplete user workflows. The traceability sub-characteristic is also in the middle range, where the system is not yet optimal in tracking data accurately throughout the business process, which risks causing report discrepancies.

In the reliability factor, the Sampos system received a score of 56%, which is included in the category of quite good. Users consider that the system is quite accurate in presenting information (accuracy), but it has not been able to avoid interruptions during use completely. This can be seen from the low error tolerance value, indicating that the system has not been able to handle user errors properly, such as automatic correction and providing clear notifications when input errors occur.

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Table 4. McCall's Score and Constraints

Factor	Presents	Category	Constraints
Correctness	56.2%	Pretty Good	Some features do not work optimally. The page view is still not fully consistent.
Reliability	56%	Pretty Good	Lack of validation or feedback when input errors occur.
Efficiency	38.2%	Bad	Navigation and layout are confusing and unsightly for users. There are still many users who are confused when they first use the system Information is not presented in a concise and easy-to-understand manner.
Integrity	47.8%	Pretty Good	Absence of security features such as layered authentication or data encryption.
Usability	46.6%	Pretty Good	Information is not clearly conveyed through the UI Lack of easy-to-understand instructions, icons, and terms for new users

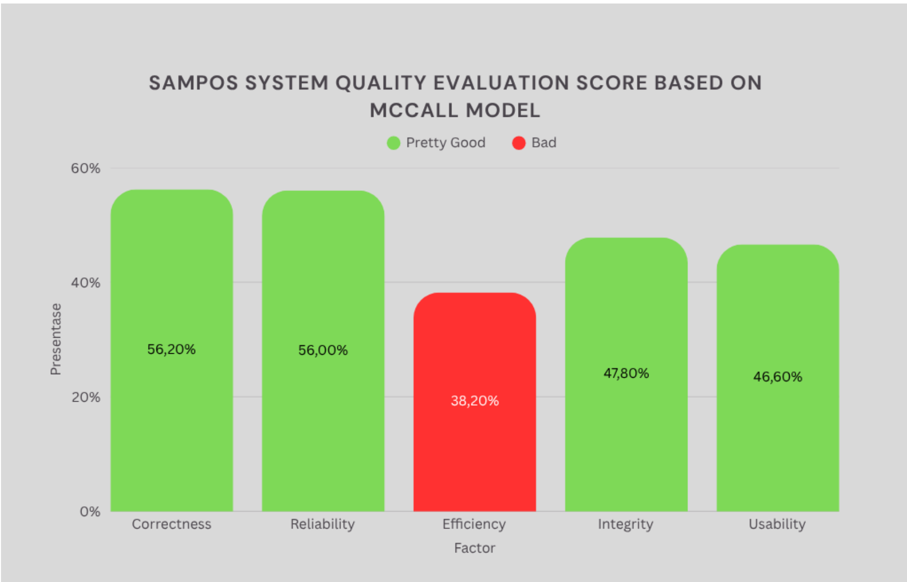

Figure 3. Sampos System Quality Evaluation Score Based on McCall Model

Factor efficiency obtained the lowest score of 38.2%, classified as poor. Although execution efficiency is higher than other sub-characteristics, users still feel that the system execution process sometimes takes a long time, as a serious obstacle in the fast food industry that demands speedy transactions. This shows that the system speed is not consistent and cannot meet user expectations in terms of responsiveness. In addition, the lowest values on conciseness and operability indicate that the information presented is not concise enough, and the system interface is difficult to operate. This shows a complex and inefficient display design, making it difficult for users to navigate or understand information quickly and easily.

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Meanwhile, the integrity factor obtained a score of 47.8%, which is in the category of quite good. The access control sub-characteristics show that the system has an adequate access control mechanism. However, the value of security sub-characteristics is very low, indicating that the protection of sensitive data remains weak; this opens the door to potential misuse of internal company data.

The usability factor achieves a score of 46.6%, which is quite good and falls within the category. The sub-characteristics of operability and training receive the highest scores, indicating that the user can understand how the system works and receive help in using it. However, the scores on the sub-characteristics of communicativeness and simplification are very low, indicating that the system design is not sufficiently communicative and simple, information is difficult to understand, and interface elements are not yet fully user-friendly.

4. DISCUSSIONS

The results of the Sampos system evaluation provide important insights into small-scale software development, namely the sharp contrast between adequate basic functionality and poor operational performance. The main contribution of the Sampos case is the confirmation that, in the context of single-developer development with minimal documentation, non-functional quality aspects such as speed and ease of use tend to be less efficient. The developer is likely to prioritize getting functions to work, but lacks a framework for optimizing their performance. This becomes clearer when compared to previous research.

The very low score on the efficiency factor in the Sampos system is a significant difference when compared to the study on the ticketing system, which reached 80.56%, most likely due to differences in development priorities. On the other hand, the "Fair" category in terms of correctness and reliability aligns with studies on CRM systems (53.4%) and school websites (54.4%), indicating that success in basic functionality but difficulty in non-functional aspects is a common trend in small-scale development.

More broadly, the findings from the Sampos case study reinforce the significance of operational quality as a predictor of user satisfaction, especially in systems that are not well-documented, a common scenario in small businesses. For practitioners, this is a reminder that performance and usability metrics should not be considered add-ons, but should be integrated from the start. For researchers, this study also demonstrates the value of pragmatic evaluation models such as McCall, which can prove to be an effective tool for performing a quick diagnosis of the health of software already in operation, when other, more complex models are difficult to apply due to documentation limitations.

Nonetheless, it is essential to acknowledge some of the study's limitations to maintain the objectivity of the interpretation. These limitations include the focus on a single case study, the potential subjectivity of data derived from user perceptions, and the limited number of respondents. These factors need to be considered when generalizing the results.

5. CONCLUSION

The evaluation of the quality of the Sampos system software based on the McCall model shows that most of the factors are in the category of quite good, namely correctness, reliability, usability, and integrity. However, the efficiency factor obtained low results, indicating that the system's performance in utilizing resources such as execution time and data processing is still not optimal. These findings show that even though the system has been functioning as intended, there are important aspects that need to be improved immediately to improve the operational quality of the system. The findings are relevant to practitioners and researchers in the field of software quality assurance, especially in the context of evaluating small-scale operational systems with minimal documentation.

Based on the results of the software quality analysis using the McCall Model on the Sampos system, several aspects were obtained that still need improvement so that performance and user experience can be optimally improved. The following recommendations are compiled to assist developers in identifying concrete steps that can be taken to improve the system, namely,

a. It is necessary to optimize system performance by reviewing the entire process that has been considered unresponsive. White-box testing can be used to identify obstacles in program logic, while regression testing needs to be done periodically to ensure the stability of key functions after an update.
b. To strengthen system security, implementing two-factor authentication, encrypting sensitive data, and logging system activities can help prevent potential misuse or unauthorized access to system data.
c. Usability is enhanced using tools such as Maze to obtain data-driven insights in real-time, related to the effectiveness of interactions and system usage flows from the user's point of view.
d. Implementing continuous and measurable improvements by conducting periodic system evaluations and preparing technical development documentation is also necessary to facilitate the tracking and adjustment process when adding features in the future.
e. For further research, it is recommended to conduct a thorough evaluation of the code structure. Additionally, evaluation is carried out routinely using automated testing to improve the system's quality over time.
f. For future, broader research, this methodology can be generalized by applying it to other systems with similar characteristics. This will strengthen the understanding that the McCall model is effective for assessing software that is already in the operational stage, not just in the development phase.

CONFLICT OF INTEREST

The author states that there is no conflict of interest between the author and the research object discussed in this paper.

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