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Measurement of Health Information Systems Using the *McCall Method*

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Abstract

In an era of technology that continues to develop rapidly, structured and detailed data management is becoming increasingly important. This allows decision makers at the Clinic to easily monitor, evaluate and plan business strategies. The information system measurement application on Klink Mitra Sadona is used to analyze the quality of the electronic registration information service system for patients. This registration system can help patients make it easier to register at the clinic. Based on this, the quality of the health information system will be measured because in this system the level of system quality is not yet known, so as to identify the accuracy, completeness and quality of the software at the clinic. The measurement method in this research uses the McCall Method. The McCall method is a method used to assess the quality of a system. The results of research based on the McCall Method show that the quality of information system measurements is very good with a percentage value of 94%, with the best indicator value, namely efficiency with a result of 72% and the integrity indicator value is the worst indicator with a result of 52%.

Keywords: Measurement, Quality, McCall Method, Indicators

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1. Introduction

The increasingly rapid development of technology certainly requires clear, structured and detailed data processing so that decision makers can easily monitor, evaluate and plan Clinic business strategies. The technology applied to process data aims to provide useful information services for the community or institutions so that clinical services can be controlled [1].

This information system application aims to assist services so that the results achieved can be optimal, apart from that the existing data is used by various parties, whether from internal parties themselves or from external parties who need services at the clinic [2][3]. Because clinical data is very vital in its existence, it would be good for the existing system to have its quality evaluated using scientific methods that have been tested, so that the reference in determining the size of a system's quality can be justified. Software measurements are also needed so that the system development that will be carried out can better suit the needs of the company's business processes by looking at the deficiencies found from the measurement results. Measurement and evaluation of an information system needs to be carried out in order to improve the system even better [4].

The application of information technology in the form of desktop-based or website-based software has become an efficient and effective strategic choice for companies in supporting the business process activities carried out. So the quality of a software becomes very important which can influence the success of implementing a software [5][6]

Mitra Sandona Clinic is one of the clinics in the city of Padang. Mitra Sandona Clinic has implemented an application to simplify patient service and management. The purpose of the application is to make the services provided to patients more effective and efficient, so that patients who come will feel satisfied with the clinic's services. However, in the implementation of the patient service information system at the Mitra Sandona Clinic, software quality measurements have never been carried out. It is very important to evaluate the information system and clinic management to find out the extent of the quality of the information system used so far, so that the quality of the system can be measured as needed or not. To measure the quality of the system, the McCall method is used.

The McCall method is a method used to assess the quality of a system by paying attention to correctness, reliability, efficiency, integrity and usability [7][8]. The stages of developing a system start from system analysis, system design, system implementation, system testing and system maintenance [9][10].
An important part or thing in system development is testing the system itself. Software or information system testing is one of the elements of software quality assurance that represents the essence of design and coding specifications [11].

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It is important to evaluate the quality of an information system or software so that the quality of the condition of the system is known as early as possible, so that from the results of the system evaluation it is known that the suitability between the service process at the Clinic and the applications used, and this evaluation is used as a basis for decision makers to determine whether this system used or replaced with another. The results of this evaluation will show the percentage of quality of the management information system at the Mitra Sandona Clinic based on the user's assessment or point of view using one of the methods for measuring the quality of a system, namely McCall's theory. From these results, it is hoped that management or policy makers will know the quality of the system they use. so that in the future policy makers can make plans for developing this system based on the results obtained from system quality tests carried out to suit user needs. The results of this testing will really help the internal development team at the Clinic in designing further system development. The system development team will pay attention and consider all input obtained from the evaluation results, every component and every function from the evaluation results will be used as a basis for further system design.

2. Research methodology

The research framework is the concept or stages that will be carried out in the research. So that the steps taken by the author in this design do not deviate from the main discussion and are easier to understand, the sequence of research steps will be made systematically so that it can be used as a clear and easy guide for solving existing problems. The research framework that the author carried out in the research can be depicted in Figure 1 .

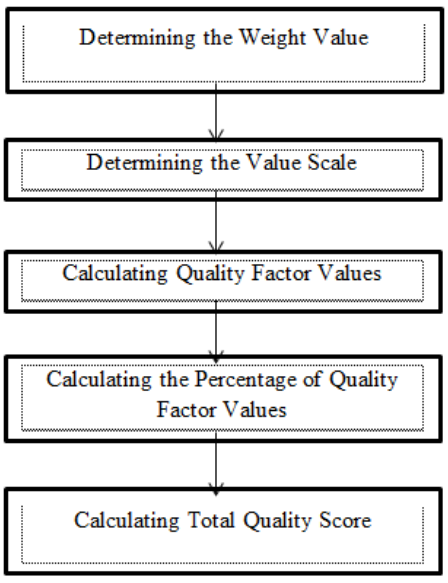

Figure 1. Research Framework

1. Determine the metrics/parameters of each quality factor.
2. Determine the weight value (w) for each quality factor and metric (0 <= w <= 1). The weight assessment scale will be based on the journal.
3. Determine the value scale. In this study, a Likert scale was used with a value range of 1-5.
4. Enter the value given by the respondent for each quality factor.
5. Calculate the average of the values given by respondents to each quality factor. The average will later be included in the criterion value.
6. Calculate the total value of each quality factor with the formula:

$$Fa = w1c1 + w2c2 + \cdots + wncn$$

Information:
Fα = Total value of factor α
wi = Weight value of factor i
ci = Criterion value i

7. Calculate the percentage of quality factor values using the formula:

$$Persentase = \frac{Nilai\ yang\ didapat}{Nilai\ Maksimum}\ x\ 100\%$$

8. After that, calculate the total value of overall application quality using the formula:

$$\sum = \frac{Nilai\ yang\ didapat\ tiap\ faktor\ kualitas}{Nilai\ Maksimum}\ x\ 100\%$$

3. Results and Discussion

3.1 Analysis Using the McCall Method

At the research stage, data was collected by interviewing Head Sadona Partner Clinic And distributing questionnaires to system users. To get the right data and information about measurement quality something system, Which own a number of indicators as benchmarks for performance measurement. Study done with processing data Which has obtained researchers, data collection was carried out from April 2022 to finished.

1. Questionnaire

The questionnaire contains statements about system activities in producing information and the quality of the health information system. The preparation of this questionnaire is in accordance with the information criteria and standard framework contained in the McCall Method. Here we use a closed type of questionnaire where the respondent just needs to fill in the answers according to the answers that have been provided and it is open for the respondent to answer

with his own answer. The answer choices offered are as follows:

SS = Strongly Agree
S = Agree
N = Neutral
T.S = Disagree
STS = Strongly Disagree

2. *Correctness* Indicators

Testing that measures the extent to which a software can meet the specifications and *mission objectives* of users.

a. Sub Indicator of Completeness (Completeness)

The extent to which full implementation of the required functions has been achieved can be seen in Table 1.

Table 1. *Completeness* Questionnaire

No	Question	SS	S	N	T.S	STS
1	This application is able to carry out data processing (display, save)					
2	All the features found in this system are functional					

b. *Consistency* Sub Indicator (consistency)

The use of uniform design and documentation techniques throughout software development projects can be seen in Table 2.

Table 2. *Consistency* Questionnaire

No	Question	SS	S	N	T.S	STS
1	The features and table design on each page are the same.					
2	The features and design of the button form on each page are the same					
3	The language used is consistent on each page					
4	The language used is consistent on each page					
5	The form and structure of data processing reporting are the same					

c. Sub Indicator *Treacebility* (tracking)

The ease of referring back implementation or program components to the needs of *software users* can be seen in Table 3.

Table 3. *Treacebility* Questionnaire

No	Question	SS	S	N	T.S	STS
1	Users can track the time (date and time) of data processing					

3. Questionnaire Based on *Usability Indicators*

Measures the effort required to learn, operate, prepare input, and interpret the output of a program.

a. Sub Indicator *Communication* (Communication)

The communication procedures implemented so that they can be understood by software users can be seen in Table 4.

Table 4. *Communication* Questionnaire

No	Question	SS	S	N	T.S	STS
1	The language used is easy to understand					
2	The writing on each page can be read clearly.					
3	The function of each button is clear.					

b. *Operability* Sub Indicator (operability)

A value measured based on the level of suitability of program operations can be seen in Table 5.

Table 5. *Operability Questionnaire*

No	Question	SS	S	N	T.S	STS
1	The menu options and buttons on the system are easy to use.					
2	Usage is easy to understand with the existing coding system					

c. Sub Indicator *Training* (training)

The level to which a software can help new users to implement or implement the software can be seen in Table 6.

Table 6. *Training* Questionnaire

No	Question	SS	S	N	T.S	STS
1	New users can easily use the system					
2	There is a hint service provided by the system to help new users.					

4. Questionnaire Based on *Integrity Indicators*

Measuring the level of ability to monitor access to data or software by certain people.

a. Sub Indicator *Security* (Security)

The availability of mechanisms that control or protect programs or data can be seen in Table 7.

Table 7. *Communication* Questionnaire

No	Question	SS	S	N	T.S	STS
1	The login process can run correctly as expected					
2	This application can control user access and limit access rights.					

5. *Realibility* Indicators

Measuring the degree to which a software or program can perform its function with the accuracy required by stakeholders.

a. Sub Indicator *Accuracy* (Accuracy)

The level of system accuracy in computing and 47ndicat can be seen in Table 5.

Table 8. *Accuracy* Questionnaire

No	Question	SS	S	N	T.S	STS
1	This application is easy to enter the input required by the system.					
2	This application can display the right data according to the user's needs precisely according to the keywords being searched for.					
3	This application provides data and information that suits user needs precisely.					
4	The information from this system is accurate And error free .					
5	Users can get the information they need in a timely manner.					
6	The output of this application is presented in the right form making it easier for users to understand.					

b. Sub *Indicator Tolerance* (tolerance)

How much the program tolerates errors that occur in the program can be seen in Table 9.

Table 9. *Training* Questionnaire

No	Question	SS	S	N	T.S	STS
1	Access to applications and data cannot be used by parties who are not entitled to use it					

c. Sub *Indicator Simpicity* (simplicity)

The degree to which a program can be understood without difficulty can be seen in Table 10.

Table 10. *Simplicity* Questionnaire

No	Question	SS	S	N	T.S	STS
1	The information in this system is easy to understand without any difficulty.					
2	The menu in this system can be easily understood without any difficulty.					

6. Questionnaire Based on *Efficiency Indicators*

Measures optimal use of system resources during correct execution.

a. Sub Indicator *Execution efficiency* (execution)

The communication procedures implemented so that they can be understood by software users can be seen in Table 11.

Table 11. *Execution Efficiency* Questionnaire

No	Question	SS	S	N	T.S	STS
1	The service menu functions and data are in accordance with needs.					
2	The interface used to operate the Mitra Sadona information system is adequate					
3	The function of the content in Mitra Sadona's information system accommodates the delivery of information from Mitra Sadona.					

3.2 McCall Method Quality Measurement

The McCall method is a method used to measure the quality of a system, which has several 4indicators as benchmarks for making measurements.

1. Determining the Weight Value

The weighting value of the criteria is determined based on the importance of the Application determined through an interview with the Head of the Mitra Sadona Clinic, as below:

0.1 = Very Unimportant
0.2 = Not Important
0.3 = Important
0.4 = Very Important

2. Looking for Criteria Values

Determining the criteria values can be done by first converting the questionnaire filling into a Likert scale as shown in Table 12 . Then divided by the number of respondents. In this study, the number of respondents was 18 people. The search criteria values are as follows:

Table 12. Questionnaire Results

No	Question	SS	S	N	T.S	STS
1	This application is able to carry out data processing (display, save).	13	36	2	0	0
2	All the features contained in the system function well.	7	35	8	1	0
3	The features and table design on each page are the same	6	22	12	11	0
4	The features and design of the forms and buttons on each page are the same	14	14	11	12	0
5	Data management on each form is the same.	9	31	10	1	0
6	The form and structure of data processing reporting are the same	12	19	14	6	0
7	The form and reporting structure for processing all data is the same.	13	20	16	2	0
8	Users can track the time (date and time) of data processing.	16	23	10	1	1
9	The language used is easy to understand.	14	24	12	1	0
10	The writing on each page can be read clearly.	12	28	9	2	0
11	The function of each button is clear.	16	16	17	1	1
12	The menu options and buttons on the system are easy to use.	11	25	12	2	1
13	Users easily understand the existing coding system.	14	22	13	0	2
14	New users can easily use the system.	8	28	10	5	0
15	There is a help service provided by the system to help new users use the system.	12	19	12	8	0
16	The login process can run correctly and according to user expectations.	3	20	25	3	0
17	This application can control user access by limiting access rights.	14	23	10	3	1
18	The application easily enters the input required by the system.	12	22	13	2	2
19	This application can precisely display data from the keywords being searched for.	6	13	13	18	1
20	This application provides data and information that suits user needs precisely.	15	21	12	3	0
21	The information from this application is accurate and error-free.	18	26	5	2	0
22	Users can get the information they need in a timely manner.	9	23	15	4	0
23	The output of this application is presented in the right form making it easier for users to understand.	9	20	19	3	0
24	Access to information system applications and data cannot be used by parties who are not entitled to use it.	8	24	16	3	0
25	The information in this application is easy to understand without any difficulty.	8	27	16	0	0
26	The menus in this application can be easily understood without any difficulty.	9	25	17	0	0
27	Does the function and data service menu meet your needs?	8	26	15	2	0
28	The interface, protocol used to operate the Sandona Partner information system is adequate.	9	26	16	0	0
29	The function of the content in the Sandona Partner information system accommodates the delivery of information from the Sandona Partner.	11	23	14	2	1

Multiply the alternative answers with the Likert scale values in Table 12. Then the multiplication results in the following criteria as in Table 13:

Table 13. Criteria Values

No	Indicator	Statement	Weight	Criterion Value
1	Correctness	Statement 1	0.4	4.21
		Statement 2	0.4	3.94
		Statement 3	0.2	3.45
		Statement 4	0.2	3.58

No	Indicator	Statement	Weight	Criterion Value
		Statement 5	0.2	3.9
		Statement 6	0.3	3.72
		Statement 7	0.2	3.86
		Statement 8	0.4	4.01
	Usability	Statement 9	0.4	4
		Statement 10	0.4	3.98
		Statement 11	0.4	3.88
2		Statement 12	0.4	3.84
		Statement 13	0.4	3.90
		Statement 14	0.4	3.76
		Statement 15	0.3	3.68
3	Integrity	Statement 16	0.4	3.45
		Statement 17	0.4	3.90
	Reliability	Statement 18	0.4	3.78
		Statement 19	0.3	3.09
		Statement 20	0.4	3.94
		Statement 21	0.4	4.17
4		Statement 22	0.4	3.72
		Statement 23	0.4	3.68
		Statement 24	0.3	3.72
		Statement 25	0.3	3.84
		Statement 26	0.3	3.84
	efficiency	Statement 27	0.3	3.78
5		Statement 28	0.4	3.86
		Statement 29	0.3	3.80

3. Measuring the Quality Factor Value

The quality factor (Fa) value is the stage of finding the value of each sub-indicator and indicator, which will later produce a value and percentage. As for formula Which used For look for mark every sub indicators are:

Fa = w1c1 + w2c2 + w3c3 + … + wncn

Where :
Fa: total value of factors

w : weight of each interest

c : value of the average matrix (criterion value)

The calculation of each *quality factor* is carried out as follows:

a. Correctness

$Completeness = (\text{w1c1} + \text{w2c2}) = (0{,}4 \text{ x } 4{,}21) + (0{,}4 \text{ x } 3{,}94) = 1.684 + 1.576 = 3.26$

$Consistency = (\text{w3c3} + \text{w4c4} + \text{w5c5} + \text{w6c6} + \text{w6c7}) = (0{,}2 \text{ x } 3{,}45) + (0{,}2 \text{ x } 3{,}58) + (0{,}2 \text{ x } 3{,}9) + (0{,}3, \text{ x } 3{,}72) + (0{,}2 \text{ x } 3{,}86 = 0{,}69 + 0{,}716 + 1{,}182 + 0{,}744 + 0{,}772 = 4{,}104$

$Treacebility = (w7c7) = (0.4\ x\ 4.01 = 1.604$

So the value of Fa1 is solved in the following way:

$$Fa1 = \frac{Completeness + Consistency + Tracebility}{3}$$

$$Fa1 = \frac{3{,}26 + 4{,}104 + 1{,}604}{3} = 2.93$$

From the results obtained from the calculations, the quality factor values are converted into percentages using the equation:

$$Presentase = \frac{Nilai\ yang\ didapat}{Nilai\ Maksimum} x\ 100\%$$

$$Presentase = \frac{2.98}{5}\ x\ 100\% = 59\%$$

b. Usability

$Communicativeness = (\text{w1c1} + \text{w2c2} + \text{w3c3}) = (0{,}4 \text{ x } 4) + (0{,}4 \text{ x } 3{,}98) + (0{,}4 \text{ x } 3{,}88) = 1{,}6 + 1{,}592 + 1{,}552 = 4{,}744$

$Operability = (\text{w4c4} + \text{w5c5}) = (0{,}4 \text{ x } 3{,}84) + (0{,}4 \text{ x } 3{,}90) = 1{,}536 + 1{,}56 = 3{,}096$

$Training = (\text{w6c6} + \text{w7c7}) = (0{,}3 \text{ x } 3{,}76) + (0{,}4 \text{ x } 3{,}68) = 1{,}128 + 1{,}472 = 2.6$

So the value of Fa2 is solved in the following way :

$$Fa2 = \frac{Communicativeness + Operability + Training}{3}$$

$$Fa2 = \frac{4{,}744 + 3{,}096 + 2.6}{3} = 3.48$$

From the results obtained from the calculations, the quality factor values are converted into percentages using the equation:

$$Presentase = \frac{Nilai\ yang\ didapat}{Nilai\ Maksimum} x100\%$$

$$Presentase = \frac{3.48}{5}\ x\ 100\% = 69\%$$

c. Integrity

$Security = (\text{w1c1} + \text{w2c2}) = (0{,}4 \text{ x } 3{,}45) + (0{,}4 \text{ x } 3{,}90) = 1{,}38 + 1{,}56 = 2{,}94$

So the value of Fa3 is solved in the following way :

$$Fa3 = \frac{Security}{1}$$

$$Fa3 = \frac{2{,}94}{1} = 2{,}94$$

From the results obtained from the calculations, the quality factor values are converted into percentages using the equation:

$$Presentase = \frac{Nilai\ yang\ didapat}{Nilai\ Maksimum}\ x100\%$$

$$Presentase = \frac{2.94}{5}\ x\ 100\% = 58\%$$

d. Reliability

$$Accuracy = (\text{w1c1} + \text{w2c2} + \text{w3c3} + \text{w4c4} + \text{w5c5} + \text{w6c6}) = (0{,}3 \text{ x } 3{,}78) + (0{,}4 \text{ x } 3{,}09) + (0{,}4 \text{ x } 3{,}94) + (0{,}4 \text{ x } \ 4{,}17) + (0{,}4 \text{ x } 3{,}72) + (0{,}3 \text{ x } 3{,}68) = 1{,}134 + 1{,}236 + 1{,}576 + 1{,}668 + 1{,}488 + 1{,}104 \ = 8{,}206$$

$$Error\ Tolerancy = (\text{w7c7}) = (0.3\text{x}3.72) = \text{x}1.116$$

$$Simplicity = (\text{w8c8} + \text{w9c9}) = (0{,}3 \text{ x } 3{,}84) + (0{,}3 \text{ x } 3{,}84) = 1{,}152 + 1{,}152 = 2{,}304$$

So the value of Fa4 is solved in the following way :

$$Fa4 = \frac{Accuracy + Error + Simplicity}{3}$$

$$Fa2 = \frac{8{,}206 + 1{,}116 + 2{,}304}{3} = 3.87$$

From the results obtained from the calculations, the quality factor values are converted into percentages using the equation:

$$Presentase = \frac{Nilai\ yang\ didapat}{Nilai\ Maksimum}\ x100\%$$

$$Presentase = \frac{3.87}{5}\ x\ 100\% = 74\%$$

e. efficiency

$$Execution\ Efficiency = (\text{w1c1}) + (\text{w2c2}) + (\text{w3c3}) = (0{,}4 \text{ x } 3{,}78) + (0{,}3 \text{ x } 3{,}86) + (\ 0{,}3 \text{ x } 3{,}80) = 1{,}512 + 1{,}158 + 1{,}14 \ = 3.81$$

So the value of Fa5 is solved in the following way :

$$Fa5 = \frac{Execution\ Efficiency}{1}$$

$$Fa5 = \frac{3.81}{1} = 3.81$$

From the results obtained from the calculations, the quality factor values are converted into percentages using the equation:

$$Presentase = \frac{Nilai\ yang\ didapat}{Nilai\ Maksimum}\ x100\%$$

$$Presentase = \frac{3.81}{5}\ x\ 100\% = 76\%$$

The functionality aspect of the questionnaire results obtained from the 18 respondents was calculated using the following formula :

$$Presentase\ Fungsionality = \frac{Nilai\ yang\ didapat}{Nilai\ Maksimum}\ x\ 100\%$$

So, the calculation of the percentage of functionality is like this:

$$= \frac{S(0{,}3*Fa1)+(0{,}3*Fa2)+(0{,}3*Fa3)+(0{,}3*Fa4)+(0{,}2*Fa5)}{Nilai\ Maksimum}\ x\ 100\%$$

$$= \frac{(0{,}3*2{,}98)+(0{,}3*3{,}48)+(0{,}3*2{,}94)+(0{,}3*3{,}87)+(0{,}2*3{,}81)}{5}\ x\ 100\%$$

$$= \frac{0{,}894+1.044+0{,}882+1{,}161+0{,}762}{5}\ x\ 100\%$$

$$= \frac{4{,}74}{5}\ x\ 100\% = 94\%$$

4. Conclusion

Based on research that has been carried out in creating a health information system at the Mitra Sandona clinic, the percentage results above were then compared with a Likert scale, which is a scale used to measure the attitudes, opinions and perceptions of a person or group of people about an event. So it can be concluded that the application in total is at a level between 81% - 100% = 94% and is included in the VERY GOOD category.

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