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User Satisfaction Level Analysis of the Website Information System Program for the Provision of Community-Based Water Supply and Sanitation Facilities Using the Method Fuzzy Service Quality

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Abstract**—** *The National Executing Agency for the Provision of Community-Based Water Supply and Sanitation Facilities runs the program supported by tools in the form of a management information system that can monitor program implementation. So far, the executing agency does not know how to assess the usefulness of the existing information system. User satisfaction assessment is very useful for executing agencies to find out whether the information system services have been so far and become input for future improvements. The fuzzy service quality (servqual) method is a method used to measure user satisfaction with this website-based management information system service. Five dimensions were analyzed using the fuzzy service quality method: tangibles, reliability, responsiveness, assurance, and empathy. These five dimensions will help application users to give a more objective assessment, while to define service satisfaction and find out the difference between reality and expectations for the services that users receive, the servqual method is used. Data collection in this study was carried out using a questionnaire which is an elaboration of the five dimensions. The results of the analysis show that all gap values on the servqual dimension have negative values, which means that the available information system services have not met the expectations of information system users. Of the 26 existing variables, only three variables satisfy system users: the website-based MIS variable equipped with a user manual with a gap value of positive 10, the web-based MIS is stable and not easy to experience bugs (errors) when accessed with a gap value of positive 15, and every complaint/complaint/error handling from application users can be received and processed quickly with a gap value of 0.*

Keywords**—** *Fuzzy Service Quality, User Satisfaction, Gap.*

I. INTRODUCTION

The Community-Based Water Supply and Sanitation Program is one of the national mainstay programs to increase rural population access to proper water supply and sanitation facilities with a community-based approach. This program started in 2008 and will continue until 2021. This program is supported by 4,900 facilitators spread over 32,400 villages to help provide water supply and sanitation facilities for the community. As a national program with a wide area coverage, executing agencies need the support of a web-based management information system to facilitate monitoring, evaluation and reporting activities to ensure their implementation. Users of this web-based management information system are facilitators who are program implementers in the field who are contracted by the executing agency manager.

As a user of the information system, the facilitator is to collect data as well as enter the data into this information system. The data contained in this information system includes the number of residents (KK, people, women, and people with disabilities), the number of beneficiaries of access to drinking water (HH, people, and women), the number of people who have not had access to drinking water (HH and people), number of the population access to sanitation (permanent healthy latrines, semi-permanent healthy latrines and sharing latrines), number of cases of diarrhea, functioning status of water supply facilities and school facilities), the status of fee implementation, number of hamlets (project intervention, project that have stopped open defecation and project interventions that have implemented Hand Washing with Soap), results of water quality inspections, operating hours, operational and maintenance costs, management of water supply facilities, planning documents, financial administration, and asset lists.

So far, the executing agency does not know how to evaluate system users on existing information system services. The available system only follows the perception of the program manager. Therefore, efforts are needed to improve information system services by taking into account the expectations of application users through measuring user satisfaction of this information system. This satisfaction measurement can be a channel to convey what users feel about the services provided by the program manager, as well as convey what users expect from the available services.

Measurement of user satisfaction level of information systems is done by knowing user expectations for the application and how the reality of the application's performance after it is implemented (Remenyi et al., 2004). Based on this expectation and reality, it is possible to know the satisfaction of a user on an application.

This study uses the fuzzy service quality method which can show the gap between perceptions and expectations of the five dimensions of service quality, namely: tangible, reliability, responsiveness, assurance, and empathy. Data

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collection in this study was carried out by distributing questionnaires to respondents. Respondents of this study were facilitators as users of information systems. The questionnaire uses a Likert scale which is displayed in the form of a checklist in the answer column. This questionnaire includes two things, namely a questionnaire containing the expectations of information system users and a questionnaire containing the reality or perception/performance perceived by information system users. The number of respondents followed the Slovin formula with an accuracy rate of 99%.

II. Literatur Review

A. User Satisfaction

System user satisfaction is the response and feedback generated by the user after using the information system. The user's attitude towards the information system is a subjective criterion of how much the user likes the system used. The level of user satisfaction can be obtained by comparing the expected results of a product/service with reality based on experience using the product/service. If the results obtained are the same then that is the level of satisfaction of the consumer, on the contrary, if the results obtained are less than expected, then it is a form of consumer dissatisfaction (Stanton 1994). Measurement of the level of user satisfaction of information systems is done by knowing the user's expectations of the application and how the reality of the performance of the application after it is implemented. A large positive gap is considered to indicate that users are satisfied with the available information system resources, whereas a large negative gap indicates that users are not satisfied with the available information resources so that it is necessary to improve the performance of the information system (Remenyi et al., 2004). Based on this expectation and reality, it is possible to know the satisfaction of a user on an application.

B. Fuzzy Service Quality

The calculation on fuzzy servqual includes the calculation of fuzzification and defuzzification. Fuzzification calculation, which is a calculation that will determine the Triangular Fuzzy Number (TFN). TFN is a range value (range of values) from the weight of respondents' answers which consists of three limit values, namely the lower limit value (a), the middle limit value (b), and the upper limit value (c). Each option has a range value which is then calculated using a formula to determine the TFN. The formula for determining the TFN is as follows (Suharyanta and A'yunin, 2011):

Lower limit value (a):

$$a_i = \frac{b_{a1}n_1 + b_{a2}n_2 + \cdots + b_{ak}n_k}{n_1 + n_2 + \cdots + n_k} \quad (1)$$

Middle limit value (b):

$$b_i = \frac{b_{b1}n_1 + b_{b2}n_2 + \cdots + b_{bk}n_k}{n_1 + n_2 + \cdots + n_k} \quad (2)$$

Upper limit value (c):

$$c_i = \frac{b_{c1}n_1 + b_{c2}n_2 + \cdots + b_{ck}n_k}{n_1 + n_2 + \cdots + n_k} \quad (3)$$

The calculation of defuzzification is a calculation for determining the crisp fuzzy value, namely calculating the average value of the lower limit value (a), the middle limit value (b), and the upper limit value (c), as follows:

$$Crisp\ Fuzzy = \frac{a+b+c}{3} \quad (4)$$

C. Gap Service Quality

Parasuraman (1990) states that expectations are strong desires about what the service provider should offer more than what the service provider will offer. These perceptions and expectations can be measured so that service providers can find out what consumers feel. Purnama (2006) states that service quality is the difference between the service perceived or perceived by service users (perception) and the ideal service desired or expected by service users (expectation). This difference figure is known as the gap or gap of service quality which is formulated as follows:

Perception – Expectation = Gap (5)

D. Validity and Reliability Test

Validity and reliability tests are very important to do considering that these two tests determine whether or not data is valid or not. A validity test illustrates how accurate and accurate a measuring instrument is in carrying out its measuring function. If the data is not accurate, it is necessary to review the preparation of the questionnaire. The validity test was calculated using the Pearson product correlation coefficient correlation formula (Kusumadewi & Hari, 2010). The instrument is said to be valid if the calculated r is greater than the r-table (Suharsimi Arikunto, 2006: 184):

$$r_{hitung} = \frac{n.(\Sigma xy) - (\Sigma x).(\Sigma y)}{\sqrt{[n.\Sigma x^2 - (\Sigma x)^2].n.[\Sigma y^2 - (\Sigma Y)^2]}} \quad (6)$$

The reliability test illustrates how far the stability and consistency of a measuring instrument are to measure the concept, as well as to determine the suitability of the measurer. This reliability test is calculated using Cronbach's alpha formula. Questionnaires are said to be reliable if tried repeatedly to the same group will produce the same data (Nikniaz et al., 2017 in Yushila et al., 2017). Cronbach's Alpha Formula:

$$r_{11} = \left[\frac{K}{(k-1)}\right]\left[1 - \frac{\sum \sigma_b^2}{\sigma_t^2}\right] \quad (7)$$

E. Population and Sampling Techniques

A population is an object or subject that is in an area and meets certain requirements related to research problems (Sugiyono, 2012). The population used in this study is the facilitator as the user of the application system that is used to input data in the form of the achievements of activities in the field. The number of facilitators who make up the population in the Community-Based Water Supply and Sanitation Facility Provision Program is 4,900 facilitators, where in these facilitators then become respondents in filling out the survey data made. Determination of the number of samples in this study using the Slovin formula as follows (Husein Umar, 2013):

$$n = \frac{N}{1 + N\,e^2} \quad (8)$$

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F. Likert Scale

The Likert scale is a scale that can show consumer responses to the characteristics of a product. The Likert scale can measure responses from subjects in the form of attitudes, opinions, and perceptions of a person or group of people about social events or phenomena on a five-point scale with equal intervals (Erlina, 2011). The Likert scale produces an ordinal measurement scale whose results are in the form of rankings without knowing how big the difference is between one response and another. Satisfaction with the same service quality attributes was asked to respondents by giving the following weights:

a. 1 for the answer strongly disagree
b. 2 for the answer disagree
c. 3 for the answer quite agree
d. 4 for the answer agree
e. 5 for the answer strongly agree

Respondents were also asked to answer the level of importance for each service quality attribute by giving the following weights:

a. 1 for a very unimportant answer
b. 2 for unimportant answer
c. 3 for the answer is quite important
d. 4 for important answers
e. 5 for a very important answer

III. Research Method

The research stages used to solve the problems in this study include: identification of problems, determination of research instruments, distributing questionnaires, testing validity and reliability, calculating fuzzification and defuzzification, and determining the value of the gap, as shown in Figure 1.

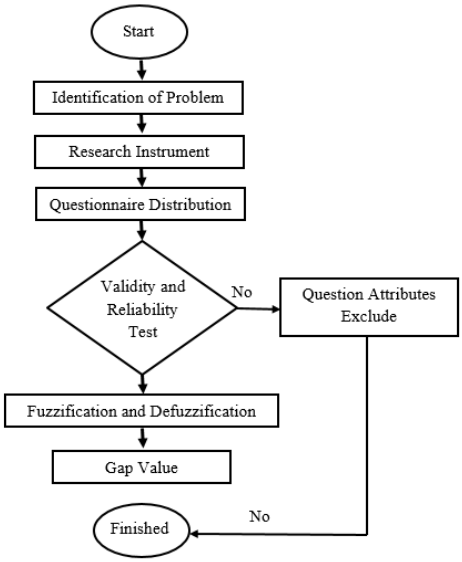

Fig. 1. Research Stage

A. Research Instrument

In this paper, the research instrument is a questionnaire with a design based on previous literature. The servqual questionnaire is the main base (Table 1).

TABLE 1. Questionnaire Design

Variable Code	Service Quality Question Variable
X1	***Tangibles***
X1-1	The web-based MIS is easily accessible at any time.
X1-2	The web-based MIS has an attractive appearance.
X1-3	Navigation on the web-based MIS is very user-friendly.
X1-4	The web-based MIS is equipped with a user manual.
X1-5	The web-based MIS provides information according to user expectations.
X1-6	The web-based MIS presents information concisely and clearly.
X1-7	The web-based MIS is relevant to the needs of community-based water supply and sanitation facilities.
X1-8	There is a web-based MIS support service available to provide technical assistance for resolving complaints/complaints/errors that appear on the system.
X2	***Reliability***
X2-9	The web-based MIS is stable and not easy to experience bugs (errors) when accessed.
X2-10	The web-based MIS provides a fast response when processing data.
X2-11	The web-based MIS is guaranteed data security.
X2-12	The web-based MIS is a real-time information system.
X2-13	The web-based MIS provides accurate information.
X2-14	The MIS team has reliable competence in serving Information system users.
X3	***Responsiveness***
X3-15	The MIS team is responsive in providing the information needed by information system users.
X3-16	Every complaint/error handling from application users can be received and processed quickly.
X3-17	The MIS team quickly provides the technical assistance users need and quickly resolves complaints/system errors submitted by users.
X4	***Assurance***
X4-18	The MIS team provides adequate system security guarantees.
X4-19	The MIS team guarantees the handling of technical problems that arise on the web-based SIM.
X4-20	The MIS team provides privacy guarantees for application users.
X4-21	The web-based MIS is guaranteed to present accurate reports.
X5	***Emphaty***
X5-22	The web-based MIS along with the user manual uses easy-to-understand grammar.
X5-23	The web-based MIS has a flow that is easy for users to understand.
X5-24	The MIS team provides clear and easy-to-understand information.
X5-25	The MIS team provides services regardless of social status and the like.
X5-26	The MIS team is very concerned about the interests of users.

B. Validity and Reliability Test

Ghozali (2016) stated that the validity test was carried out to measure the level of validity of the research questionnaire. The measurement of the validity level of this questionnaire uses the Pearson product-moment formula. The reliability test was conducted to measure the reliability or consistency of the research questionnaire. The calculation of this reliability test uses Cronbach's Alpha formula. Processing the validity and reliability test data using SPSS software.

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C. *Fuzzification and Defuzzification*

The calculation of fuzzification in this study uses the Overall Effectiveness Measure formula to produce the lower, middle, and upper limits, while the calculation of defuzzification uses the crisp fuzzy formula.

D. *Gap Value*

In this study, the gap is the gap or difference between the perceptions and expectations of users of information system services. After obtaining the defuzzification value for the perception level and the defuzzification for the expected level, then the gap value for each attribute is calculated using the perception defuzzification formula subtracted from the expected defuzzification. If the results of the assessment of perceptions and expectations are positive, then the information system service provided is very satisfying, but if the difference in perception and expectation is zero, then the information system service provided is satisfactory, but if the difference in perception and expectation is negative then the service provided is said to be not satisfying.

IV. Result and Discussion

Validity testing was carried out on 3,289 respondents by looking at the calculated r-count (Corrected item-total Correlation) > r table of 0.0449, for df = 3.289 – 2, and = 0.01 then it is declared valid and vice versa. The results of the validity test of the perception and expectation data can be seen in Table 2.

TABLE 2. Perception and Expectation Data Validity Test Results

Variable	Expectation Data			Perception Data		
	r_{count}	r_{tabel} 1% (N = 3.289)	Validity	r_{count}	r_{tabel} 1% (N = 3.289)	Validity
X1-1	0,777	0,0449	Valid	0,810	0,0449	Valid
X1-2	0,787	0,0449	Valid	0,829	0,0449	Valid
X1-3	0,832	0,0449	Valid	0,870	0,0449	Valid
X1-4	0,768	0,0449	Valid	0,833	0,0449	Valid
X1-5	0,827	0,0449	Valid	0,872	0,0449	Valid
X1-6	0,829	0,0449	Valid	0,869	0,0449	Valid
X1-7	0,808	0,0449	Valid	0,839	0,0449	Valid
X1-8	0,793	0,0449	Valid	0,825	0,0449	Valid
X2-9	0,828	0,0449	Valid	0,832	0,0449	Valid
X2-10	0,869	0,0449	Valid	0,887	0,0449	Valid
X2-11	0,850	0,0449	Valid	0,872	0,0449	Valid
X2-12	0,810	0,0449	Valid	0,850	0,0449	Valid
X2-13	0,820	0,0449	Valid	0,851	0,0449	Valid
X2-14	0,841	0,0449	Valid	0,882	0,0449	Valid
X3-15	0,877	0,0449	Valid	0,914	0,0449	Valid
X3-16	0,928	0,0449	Valid	0,944	0,0449	Valid
X3-17	0,930	0,0449	Valid	0,943	0,0449	Valid
X4-18	0,902	0,0449	Valid	0,925	0,0449	Valid
X4-19	0,898	0,0449	Valid	0,919	0,0449	Valid
X4-20	0,890	0,0449	Valid	0,919	0,0449	Valid
X4-21	0,888	0,0449	Valid	0,906	0,0449	Valid
X5-22	0,872	0,0449	Valid	0,906	0,0449	Valid
X5-23	0,893	0,0449	Valid	0,915	0,0449	Valid
X5-24	0,901	0,0449	Valid	0,927	0,0449	Valid
X5-25	0,838	0,0449	Valid	0,867	0,0449	Valid
X5-26	0,866	0,0449	Valid	0,895	0,0449	Valid

This study uses the Cronbach's Alpha formula contained in the IBM SPSS Statistics 26 software to perform a reliability test. The instrument is said to be reliable or consistent if the Cronbach's Alpha value is > 0.60. The results of the reliability test can be seen in Figure 2.

Number	Dimensi (n = Jumlah Item)	Expectation		Perception	
		Cronbach's Alpha	Result	Cronbach's Alpha	Result
1.	*Tangibles* (n = 8)	0,920	Reliable	0,941	Reliable
2.	*Reliability* (n = 6)	0,909	Reliable	0,926	Reliable
3.	*Responsiveness* (n = 3)	0,898	Reliable	0,926	Reliable
4.	*Assurance* (n = 4)	0,917	Reliable	0,937	Reliable
5.	*Emphaty* (n = 5)	0,923	Reliable	0,943	Reliable

Fig. 2. Perception and Expectation Data Reliability Test Results

Overall, the results of the reliability test can be seen in Figure 2. Based on Figure 2 the results of the reliability test, it is known that all Cronbach's Alpha values are above 0.60 both for perception data and expectation data, so it can be stated that all questionnaire questions are reliable or feasible to be used as research. The results of the calculation of fuzzification and defuzzification by variables for perception data can be seen in Table 3, while the expectation data can be seen in Table 4.

TABLE 3. Recapitulation Result Level of Perception and Defuzzification by Variable

Variable	TFN			Defuzzification
	a_1	b_1	c_1	
X1-1	1.815	2.632	3.106	2.517
X1-2	1.733	2.551	3.079	2.454
X1-3	1.789	2.608	3.119	2.505
X1-4	1.835	2.656	3.141	2.544
X1-5	1.881	2.702	3.164	2.583
X1-6	1.911	2.732	3.167	2.603
X1-7	1.951	2.773	3.188	2.637
X1-8	1.805	2.624	3.105	2.511
X2-9	1.557	2.364	2.914	2.278
X2-10	1.746	2.565	3.065	2.459
X2-11	1.898	2.717	3.153	2.589
X2-12	1.893	2.714	3.171	2.592
X2-13	1.929	2.751	3.178	2.619
X2-14	1.867	2.687	3.146	2.567
X3-15	1.860	2.680	3.142	2.560
X3-16	1.747	2.564	3.066	2.459
X3-17	1.771	2.590	3.083	2.481
X4-18	1.900	2.720	3.159	2.593
X4-19	1.843	2.664	3.135	2.547
X4-20	1.919	2.740	3.169	2.609
X4-21	1.912	2.733	3.171	2.605
X5-22	1.907	2.728	3.166	2.600
X5-23	1.889	2.709	3.161	2.586
X5-24	1.917	2.739	3.169	2.608
X5-25	1.993	2.814	3.195	2.667
X5-26	1.915	2.736	3.168	2.606

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TABLE 4. Recapitulation Result Level of Expectation and Defuzzification by Variable

Variable	TFN			Defuzzification
	a_1	b_1	c_1	
X1-1	1.944	2.765	3.176	2.628
X1-2	1.740	2.559	3.088	2.462
X1-3	1.794	2.613	3.114	2.507
X1-4	1.826	2.646	3.129	2.534
X1-5	1.959	2.779	3.180	2.639
X1-6	1.966	2.786	3.183	2.645
X1-7	2.007	2.828	3.196	2.677
X1-8	1.868	2.686	3.123	2.559
X2-9	1.547	2.354	2.889	2.263
X2-10	1.763	2.579	3.050	2.464
X2-11	1.952	2.770	3.152	2.624
X2-12	1.910	2.731	3.173	2.605
X2-13	1.984	2.805	3.186	2.658
X2-14	1.898	2.717	3.152	2.589
X3-15	1.890	2.709	3.149	2.583
X3-16	1.752	2.568	3.057	2.459
X3-17	1.786	2.604	3.085	2.492
X4-18	1.935	2.755	3.169	2.620
X4-19	1.869	2.690	3.143	2.567
X4-20	1.970	2.792	3.178	2.646
X4-21	1.960	2.782	3.180	2.641
X5-22	1.981	2.802	3.186	2.656
X5-23	1.954	2.775	3.174	2.634
X5-24	1.957	2.779	3.179	2.638
X5-25	2.027	2.849	3.200	2.692
X5-26	1.942	2.762	3.171	2.625

The results of the calculation of fuzzification and defuzzification by dimensions for perception data can be seen in Table 5, while the expectation data can be seen in Table 6.

TABLE 5. Recapitulation Result Level of Perception and Defuzzification by Dimensions

Dimension	TFN			Defuzzification
	a_1	b_1	c_1	
Tangible	14.720	21.278	25.067	20.355
Reliability	10.890	15.797	18.627	15.105
Responsiveness	5.378	7.835	9.290	7.501
Assurance	7.573	10.858	12.634	10.355
Emphaty	9.621	13.727	15.857	13.068

TABLE 6. Recapitulation Result Level of Expectation and Defuzzification by Dimensions

Dimension	TFN			Defuzzification
	a_1	b_1	c_1	
Tangible	15.104	21.664	25.187	20.651
Reliability	11.054	15.956	18.600	15.204
Responsiveness	5.428	7.882	9.291	7.533
Assurance	7.735	11.018	12.669	10.474
Emphaty	9.861	13.967	15.909	13.246

Table 7 shows the results of the Gap calculation for each variable. Only three variables with non-negative gap values: X1-4, X2-9, and X3-16. This means that these three variables satisfy users of information systems.

Table 8 shows the results of the Gap calculation for each dimension. All dimensions show a negative gap value, which means that all dimensions do not meet system user satisfaction. Successively system user satisfaction is based on dimensions starting from the highest satisfaction: tangible, empathy, assurance, reliability, and finally responsiveness.

TABLE 7. Gap calculation for each Variable

Variable	Defuzzification		*Gap*	Ranking
	Perception	Expectation		
X1-1	2.517	2.628	-111	1
X1-2	2.454	2.462	-8	21
X1-3	2.505	2.507	-2	23
X1-4	2.544	2.534	10	25
X1-5	2.583	2.639	-57	2
X1-6	2.603	2.645	-42	6
X1-7	2.637	2.677	-40	7
X1-8	2.511	2.559	-48	5
X2-9	2.278	2.263	15	26
X2-10	2.459	2.464	-5	22
X2-11	2.589	2.624	-35	11
X2-12	2.592	2.605	-12	19
X2-13	2.619	2.658	-39	8
X2-14	2.567	2.589	-22	15
X3-15	2.560	2.583	-22	16
X3-16	2.459	2.459	0	24
X3-17	2.481	2.492	-10	20
X4-18	2.593	2.620	-26	13
X4-19	2.547	2.567	-20	17
X4-20	2.609	2.646	-37	9
X4-21	2.605	2.641	-35	10
X5-22	2.600	2.656	-56	3
X5-23	2.586	2.634	-48	4
X5-24	2.608	2.638	-30	12
X5-25	2.667	2.692	-25	14
X5-26	2.606	2.625	-19	18

TABLE 8. Gap calculation for each Dimension

Variable	Defuzzification		*Gap*	Ranking
	Perception	Expectation		
Tangible	20.355	20.651	-297	1
Reliability	15.105	15.204	-99	4
Responsiveness	7.501	7.533	-32	5
Assurance	10.355	10.474	-119	3
Emphaty	13.068	13.246	-177	2

V. Conclusion and Suggestion

A. Conclusion

Thus only three variables that meet user expectations are indicated by a non-negative gap value: X2-9 (The web-based MIS is stable and not easy to experience bugs (errors) when accessed) with a positive gap value of 15, followed by X1-4 (The web-based MIS is equipped with a user manual) with a positive gap value of 10 and X3-16 (Every complaint/error handling from application users can be received and processed quickly). However, all gaps are negative based on dimensions, meaning that all dimensions have not met the expectations of system users.

B. Suggestion

Further research can be done by comparing respondents in Java with those outside Java to find out whether there is an influence of human resources and system infrastructure on service satisfaction.

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