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Measurement Of Customer Satisfaction Using Fuzzy Service Quality Method At PT.ABC

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ABSTRACT

Customer satisfaction is obtained by someone when they feel satisfied or dissatisfied based on a comparison of product or service performance with their expectations. This factor is very crucial in assessing whether an industry, especially the service industry, is successful or not. The quality of customer satisfaction can be assessed through the difference between customer expectations and perceptions. PT. ABC effectively provides information to customers about the evaluation of the quality of services provided by its employees, as well as the factors that have an influence on the level of customer satisfaction in using these services. This study aims to measure and evaluate the quality of service with the Service Quality method, namely comparing customer expectations and perceptions. For this reason, Service Quality consists of five main dimensions, namely tangibles (physical factors), reliability (reliability), responsiveness (responsiveness), assurance (certainty), and empathy (empathy). The results showed that the service quality of PT.ABC is close to 7. This proves that PT.ABC must improve the quality of its services so that customers feel very satisfied. The highest factor is the factor that most influences customer satisfaction and has the highest gap, which is the assurance factor.

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Introduction

Quality has an important role in efforts to increase, maintain and regain market share in business companies, both manufacturing and service companies(Jami Pour et al., 2020).The quality of service provided to consumers to create customer satisfaction is the key to success to excel in business competition(Ishak & Wanli, 2020). Therefore, it is necessary to measure the level of service quality to determine the performance of the services provided by determining the gap between expectations and consumer perceptions of the service they receive. (Brahmana & Rohayati, 2022)(Fitriana et al., 2019)

Quality of service is an important factor for service providers in achieving the quality received in accordance with the service expected by consumers (Adebiyi et al., 2022).The gap between expectations and consumer perceptions needs to find a solution to reduce and/or eliminate this gap (Nguyen, 2021). Consumer expectations are service expectations based on consumer needs whose results can be less or more than reality(Yuan et al., 2020). While consumer perception is the consumer's perspective in assessing a service provided which can be measured from suitability or not.(Bakir & Atalik, 2021)

The fuzzy concept can be used to connect uncertainty over respondents' assessments of subjective questionnaires to become more objective. Prioritization of improvement plans is also required to improve service quality. The basis of fuzzy logic is fuzzy set theory with the degree of membership as a determinant of the existence of elements of a set(Yunanto & Astini, 2020). The membership value or degree of membership or membership function is the main feature of the reasoning from the fuzzy logic. In the fuzzy set the membership value lies in the range 0 to 1. (Fajri Hasibuan, 2020)

In the current technological developments, the author wants to help PT. ABC in measuring the level of customer satisfaction with the services provided by PT. ABC every 3 months (Karmeita et al., 2020). Requires a system change from the old system which some still use documents and files or are still manual to a more computerized system(Titin Herawaty et al., 2022). Given the large number of customers who number in the hundreds, making it difficult for parties to measure the level of customer satisfaction.(Velazco Gonzales et al., 2021)

Problems about service are often complained of by customers at PT. ABC, especially during product sales services and there is often a delay in the delivery of goods from the specified schedule(Sari et al., 2018). So far, PT. ABC has not measured customer satisfaction, so management does not know the level of customer satisfaction with the quality of services that have been performed. (Afroj et al., 2021)

Among the various methods of measuring service quality, one of them is using the Fuzzy Service Quality method. (Behdioğlu et al., 2019)Fuzzy Service Quality is the most widely used method in analyzing customer service satisfaction. In full, Service Quality measures five GAPs (Gaps)(Miranda et al., 2018), but the point of emphasis and attention is the GAP between customer perceptions and expectations (Luke & Heyns, 2020)(Zun et al., 2018). In general, the assessment of perceptions and expectations on Servqual uses a Likert scale which has a value range between 1 to 5 to express the level of satisfaction and level of interest. (Alam & Mondal, 2019)(Souri et al., 2018). The Fuzzy concept was chosen in determining the level of customer perceptions and expectations because the range of values used by Fuzzy is able to bridge between one's predictions and the processed data. (RiyazhKhan & Haq, 2019)(Galanakis & Goula, 2022)

Method

Service quality can be defined as how far the difference is between reality and customer expectations for the service received. Service quality can be identified by comparing customer perceptions of service with the service they actually receive (Goula et al., 2022). Service Quality can be identified by comparing customer perceptions of the real service they receive/obtain with the service they actually expect/want. (Zhang et al., 2022) (Sam et al., 2018)If the reality is more than expected, then the service can be said to be of high quality. Meanwhile, if the reality is less than expected then the service can be said to be of less quality, if the reality is the same as expected then the service is said to be satisfactory.(Javed et al., 2019)(Goumairi et al., 2020)

Define Criteria

The criteria proposed by the company are covered in 5 dimensions, namely Physical Evidence, Reliability, Responsiveness, Assurance and Emphaty which is called Service Quality Instrument, can be seen in table 1 below: (Altuntas et al., 2022)(Katelo et al., 2021)

Table 1. Criteria based on service quality Instrument

No.	Dimensions	Statement Attributes Service Quality [a]
1	Physical Evidence	1. The company has neat toilets and front office (Q1)(Satisfied) 2. Employees Dress in Uniforms and Neatly (Q2) (Satisfied) 3. Company location is easy to reach (Q3)(Not Satisfied)
2	Reliability	1. The company provides services as promised (Q4) (Satisfied) 2. The company provides services according to the promised time (Q5) (Satisfied) 3. Company employees can be relied upon in dealing with consumer problems. (Q6) (Satisfied)
3	Responsiveness	1. The company provides fast service (Q7) (Not Satisfied) 2. Willingness of Company employees to help consumers. (Q8)(Not Satisfied) 3. Consumers get sufficient service time from Company employees. (Q9) (Satisfied)

4	Assurance	1. Employees have skills that support their jobs. (Q10)(Satisfied) 2. Consumers feel safe and comfortable interacting and transacting with employees. (Q11)(Not Satisfied) 3. Employees are polite and friendly to consumers (Q12) (Not Satisfied)
5	Empathize	1. Employees provide individual services to consumers. (Q13) (Satisfied) 2. Employees prioritize consumer interests (Q14) (Not Satisfied)

Value Calculation Fuzzy Service Quality
Fuzzy Service Quality value calculation is done using the following formula: (Al-Neyadi et al., 2018)(Hamdani et al., 2021)

$$Upper\ limit(a) = \frac{b_{i2} * n_1 + b_{i3} * n_2 + \ldots + b_{ik} * n_{i(k-1)} + b_{ik} * n_k}{n_1 + n_2 + n_3 + \ldots . n_{(k-1)} + n_{jk}} \quad (1)$$

$$Middle\ limit(b) = \frac{b_{i1} * n_1 + b_{i1} * n_2 + b_{i2} * n_3 + \ldots . + b_{ik} * n_k}{n_1 + n_2 + n_3 + \ldots . n_k} \quad (2)$$

$$Lower\ limit(c) = \frac{b_{i1} * n_1 + b_{i1} * n_2 + b_{i2} * n_3 + \cdots . + b_{i(k-1)} * n_k}{n_1 + n_2 + n_3 + \ldots . n_k} \quad (3)$$

Description :
b_i = average value of the fuzzy set per level of importance
n = number of respondents

Fuzzy Service Quality Gap Calculation Results
Ranking is carried out from the highest value to the lowest value using the perception minus expectation formula (Ijadi Maghsoodi et al., 2019)(Hamdani et al., 2021). The results of calculating the fuzzy fication value can be seen in the table below:

Gap = Perceptions – Expectations (4)

If the Gap result >= 0 then Satisfaction = " Satisfied ", if the Gap result < 0 then Customer Satisfaction = "Not Satisfied" .

Results and Discussions

Problem analysis is the first stage in the analysis phase which aims to identify and evaluate the problems that occur so that improvements can be proposed. (Thirumal Azhagan et al., 2021)Problem can be defined as a question that will be solved so that the system can be solved optimally (Al-Neyadi et al., 2018) (Hamdani et al., 2021)
After doing research at PT. ABC, several problems can be found as follows:

a. The absence of a specific system and decision support system method that is able to provide decisions on customer satisfaction results for services at PT. ABC.
b. Inefficiency of the running system in providing services to customers.
c. The need to improve the quality of service to customers at PT. ABC.

Sample case :
Thus, the value that we use in determining the weight (score) that we use to calculate the fuzzification value is Not satisfied with values 1, 2, 3, 4, the value for Dissatisfied is 3, 4, 5, 6, the value is Enough Satisfied is 5 , 6, 7, 8, Satisfaction Score 7,8,9,10 and scores for Very Satisfied 9, 10,11,12.
The following are the results of the customer assessment on the questionnaire distributed on the satisfaction of the services provided by the company to customers, which can be seen in Figure 1 below: (Khulan et al., 2018)

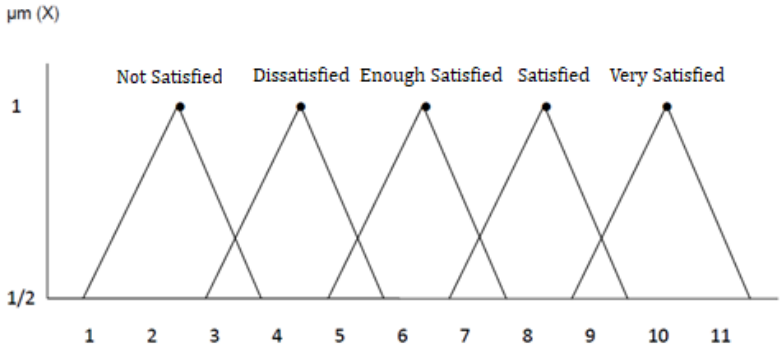

Figure. 1. Determination of Fuzzy Set Values

In calculating the fuzzyfication value of the Questionnaire, where the fuzzyfication value is the average value of the values c, a, b. ranking from highest to lowest.

Table 2 Results of the Customer Questionnaire Assessment

No	Customer's name	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14
1	Eko	8	9	9	9	9	9	9	8	8	8	8	8	8	8
2	Erna	9	7	8	9	8	9	8	7	9	9	9	9	7	7
3	Fitra	9	8	7	8	9	9	8	9	8	9	8	8	9	9
4	Fitrianti	9	8	6	5	8	8	8	8	8	8	8	9	8	8
5	Gunawan	8	7	7	6	7	9	7	5	9	9	8	8	8	7
6	Gina	7	7	7	9	9	9	8	8	5	8	9	9	8	7
7	Bernad	8	8	9	8	7	9	9	9	9	5	9	8	7	6
8	Andika	9	7	8	9	5	6	8	9	9	9	8	6	6	6
9	Jhonson	8	9	8	9	9	7	8	9	9	9	8	6	6	8
10	Risdawati	7	7	9	7	6	9	9	9	9	8	8	8	8	7
11	M. Toha	7	8	8	8	9	9	8	7	9	8	8	8	8	7
12	Doni Rahmad	8	8	9	8	9	7	8	7	8	8	8	7	7	7
13	Darman	8	8	7	8	9	9	8	7	8	7	8	7	9	9
14	Edo Putra	8	8	8	8	7	9	9	7	9	7	8	6	7	8
15	Sigit Pranoto	8	8	8	8	8	7	8	7	8	8	6	7	8	8
16	Ramlan	8	8	7	8	7	9	7	7	8	8	8	6	6	6
17	Cindy	7	7	8	8	9	8	8	9	8	8	8	7	9	8
18	Abdul Rahman	8	8	7	9	8	9	8	9	8	8	8	8	8	8
19	Kenzi	7	8	7	8	8	8	6	6	8	7	8	7	8	8

Questionnaire Criteria Results

After determining the Fuzzy Set value, the results of the customer satisfaction assessment can be seen as follows:

Table 3. Summing results of the sub-questionnaire criteria

SubCriteria	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	TOTAL
Very Satisfied	4	2	4	6	8	12	4	7	8	5	3	3	3	2	71
Satisfied	10	11	7	10	5	3	12	3	10	10	15	7	9	8	120
Enough Satisfied	5	6	8	2	5	4	3	8	0	3	1	9	7	9	70
Dissatisfied	0	0	0	1	1	0	0	1	1	1	0	0	0	0	5
Not satisfied	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Lower Limit Value Calculation

Calculation of the lower limit value on Fuzzy Service quality can be calculated using the following formula:

$$Lower\ limit(c) = \frac{b_{i1}*n_1+b_{i1}*n_2+b_{i2}*n_3+\cdots.+b_{i(k-1)}*n_k}{n_1+n_2+n_3+\ ....n_k}$$

Table 4. Summing results of the Lower Limit Value Calculation

Lower Limit value (c)						
Code	Not satisfied	Dissatisfied	Enough Satisfied	Satisfied	Very Satisfied	TOTAL
Q1	0	0	25	70	36	6.894737
Q2	0	0	30	77	18	6.578947
Q3	0	0	40	49	36	6.578947
Q4	0	3	10	70	54	7.210526
Q5	0	3	25	35	72	7.105263
Q6	0	0	20	21	108	7.842105
Q7	0	0	15	84	36	7.105263
Q8	0	3	40	21	63	6.684211
Q9	0	3	0	70	72	7.631579
Q10	0	3	15	70	45	7
Q11	0	0	5	105	27	7.210526
Q12	0	0	45	49	27	6.368421
Q13	0	0	35	63	27	6.578947
Q14	0	0	45	56	18	6.263158

Middle Limit Value Calculation

Calculation of the middle limit value on Fuzzy Service quality can be calculated using the following formula:

$$Middle\ limit(b) = \frac{b_{i1}*n_1+b_{i1}*n_2+b_{i2}*n_3+.....+b_{ik}*n_k}{n_1+n_2+n_3+\ ....n_k}$$

Table 5. Summing results of the Middle Limit Value Calculation

Middle limit value (b)						
Code	Not satisfied	Dissatisfied	Enough Satisfied	Satisfied	Very Satisfied	TOTAL
Q1	0	0	32.5	85	42	8.394737
Q2	0	0	39	93.5	21	8.078947
Q3	0	0	52	59.5	42	8.078947
Q4	0	4.5	13	85	63	8.710526
Q5	0	4.5	32.5	42.5	84	8.605263
Q6	0	0	26	25.5	126	9.342105
Q7	0	0	19.5	102	42	8.605263
Q8	0	4.5	52	25.5	73.5	8.184211
Q9	0	4.5	0	85	84	9.131579
Q10	0	4.5	19.5	85	52.5	8.5
Q11	0	0	6.5	127.5	31.5	8.710526
Q12	0	0	58.5	59.5	31.5	7.868421
Q13	0	0	45.5	76.5	31.5	8.078947
Q14	0	0	58.5	68	21	7.763158

Upper Limit Value Calculation

Calculation of the upper limit value on Fuzzy Service quality can be calculated using the following formula:

$$Upper\ limit(a) = \frac{\boldsymbol{b_{i2}*n_1+b_{i3}*n_2+\ldots+b_{ik}*n_{i(k-1)}+b_{ik}*n_k}}{\boldsymbol{n_1+n_2+n_3+\ ....n_{(k-1)}+n_{jk}}}.$$

Table 6. Summing results of the Upper Limit Value Calculation

Upper limit value (a)						
Code	Not satisfied	Dissatisfied	Enough Satisfied	Satisfied	Very Satisfied	TOTAL
Q1	0	0	30	80	40	7,894737

Q2	0	0	36	88	20	7,578947
Q3	0	0	48	56	40	7,578947
Q4	0	4	12	80	60	8,210526
Q5	0	4	30	40	80	8,105263
Q6	0	0	24	24	120	8,842105
Q7	0	0	18	96	40	8,105263
Q8	0	4	48	24	70	7,684211
Q9	0	4	0	80	80	8,631579
Q10	0	4	18	80	50	8
Q11	0	0	6	120	30	8,210526
Q12	0	0	54	56	30	7,368421
Q13	0	0	42	72	30	7,578947
Q14	0	0	54	64	20	7,263158

Fuzzification Gap Calculation Results

Ranking is carried out from the highest value to the lowest value using the perception minus expectation formula. The results of calculating the Fuzzification value can be seen in the table below:

Gap = Perceptions – Expectations ……(4)

If the Gap result >= 0 then Satisfaction = " Satisfied ", if the Gap result < 0 then Customer Satisfaction = "Not Satisfied"

The following is the calculation result for each dimension criterion used:

Table 7. The Calculation Result For physical Evidence Criterion

Code	Criteria	Perceptions	Expectations	GAP	Rank
Q1	The company has neat toilets and front office	8,144736842	8	0,144736842	Satisfied
Q2	Employees Dress in Uniforms and Neatly	7,828947368	7	0,828947368	Satisfied
Q3	Company Location is Easy to Reach	7,828947368	8	-0,171052632	Not Satisfied
TOTAL		23,80263	23	0,802632	
AVERAGE		7,934211	7.666	0,267544	
SATISFACTION		SATISFIED			

Table 8. The Calculation Result For Reliability Criterion

Code	Criteria	Perceptions	Expectations	GAP	Rank
Q4	The company provides services as promised	8,460526316	8	0,460526316	Satisfied
Q5	The company provides services according to the promised time	8,355263158	7	1,355263158	Satisfied
Q6	Company employees can be relied upon in dealing with consumer problems	9,092105263	8	1,092105263	Satisfied
TOTAL		25,90789	23	2,907895	
AVERAGE		8,635965	7.666	0,969298	
SATISFACTION		SATISFIED			

Table 9. The Calculation Result For Responsiveness Criterion

Code	Criteria	Perceptions	Expectations	GAP	Rank
Q7	The company provides fast service	8,355263158	9	-0,644736842	Not Satisfied
Q8	Willingness of Company employees to help consumers.	7,934210526	8	-0,065789474	Not Satisfied
Q9	Consumers get sufficient service time from Company employees.	8,881578947	7	1,881578947	Satisfied
TOTAL		25,17105	24	1,171053	

AVERAGE	8,390351	8	0,390351
SATISFACTION	SATISFIED		

Table 10. The Calculation Result For Assurance Criterion

Code	Criteria	Perceptions	Expectations	GAP	Rank
Q10	Employees have skills that support their jobs.	8,25	8	0,25	Satisfied
Q11	Consumers feel safe and comfortable interacting and transacting with employees.	8,460526316	7	1,460526316	Not Satisfied
Q12	Employees are polite and friendly to consumers.	7,618421053	8	-0,381578947	Not Satisfied
TOTAL		24,32895	23	4,328947	
AVERAGE		8,109649	7.666	0,442982	
SATISFACTION		SATISFIED			

Table 11. The Calculation Result For Empathize Criterion

Code	Criteria	Perceptions	Expectations	GAP	Rank
K13	Employees provide individual services to consumers	7,828947368	7	0,828947368	Satisfied
K14	Employees prioritize consumer interests	7,513157895	8	-0,486842105	Not Satisfied
TOTAL		15,34211	15	0,342105	
AVERAGE		7,671053	5	0,780702	
SATISFACTION		SATISFIED			

If the reality is more than expected, then the service can be said to be of high quality. Whereas if the reality is less than expected then the service can be said to be of less quality, if the reality is the same as expected then the service is said to be satisfactory.

Table 12. Results of Customer Satisfaction Analysis

Code	Questionnaire	Perceptions	Lower Value	Middle Value	Upper Value	Defuzzification	GAP	Satisfaction
Q1	The company has neat toilets and front office	8	6.894737	8.394737	7,894737	8,144736842	0,144736842	Satisfied
Q2	Employees Dress in Uniforms and Neatly	7	6.578947	8.078947	7,578947	7,828947368	0,828947368	Satisfied
Q3	Company Location is Easy to Reach	8	6.578947	8.078947	7,578947	7,828947368	-0,171052632	Tidak Puas
Q4	The company provides services as promised	8	7.210526	8.710526	8,210526	8,460526316	0,460526316	Satisfied
Q5	The company provides services according to the promised time	7	7.105263	8.605263	8,105263	8,355263158	1,355263158	Satisfied
Q6	Company employees can be relied upon in dealing with consumer problems	8	7.842105	9.342105	8,842105	9,092105263	1,092105263	Satisfied
Q7	The company provides fast service	9	7.105263	8.605263	8,105263	8,355263158	-0,644736842	Not Satisfied
Q8	Willingness of Company employees to help consumers.	8	6.684211	8.184211	7,684211	7,934210526	-0,065789474	Not Satisfied

Q9	Consumers get sufficient service time from Company employees.	7	7.631579	9.131579	8,631579	8,881578947	1,881578947	Satisfied
Q10	Employees have skills that support their jobs.	8	7	8.5	8	8,25	0,25	Satisfied
Q11	Consumers feel safe and comfortable interacting and transacting with employees.	7	7.210526	8.710526	8,210526	8,460526316	1,460526316	Satisfied
Q12	Employees are polite and friendly to consumers.	8	6.368421	7.868421	7,368421	7,618421053	-0,381578947	Not Satisfied
Q13	Employees provide individual services to consumers	7	6.578947	8.078947	7,578947	7,828947368	0,828947368	Satisfied
Q14	Employees prioritize consumer interests	8	6.263158	7.763158	7,263158	7,513157895	-0,486842105	Not Satisfied

Service Quality Results

Lower Value = 6.93233082706766
Middle Value =8.43233082706764
Upper Value = 7.93233082706771
Defuzzification = 8.14285714285714
GAP =0.428571428571429

Based on the results of calculations with the fuzzy service quality algorithm, GAP is positive with an average value of 0.40.428571428571429, so the results of measuring customer service satisfaction can be stated as satisfied.

Conclusions

As for the conclusions drawn by the authors in the form of the creation of a new criteria that can measure the level of customer satisfaction at PT. ABC and the system created by the author can be applied to PT.ABC so that inputting data to measure customer satisfaction is faster with a decision support system using the Fuzzy Service Quality Method where the system can find out dissatisfaction with customer service in assessing customer satisfaction and can simplify and speed up user/ users in assessing customers. The Fuzzy Service Quality Method analysis reveals that reliability, responsiveness, and empathy are the most influential dimensions in determining customer satisfaction. These areas receive consistently high ratings from customers. PT. ABC's service quality is benchmarked against key competitors in the industry. The company is found to be performing at par with or slightly better than its competitors in most service dimensions. Further development of this research in the future involves combining the Fuzzy Service Quality Method with other customer satisfaction measurement techniques, such as Net Promoter Score (NPS) or Customer Effort Score (CES), to triangulate findings and obtain a more comprehensive view of customer satisfaction. Develop predictive models that anticipate changes in customer satisfaction based on changes in service quality metrics. This can help PT. ABC proactively address potential issues.

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