Analysis of Customer Satisfaction in a Selected Bank: Signal-To-Noise Ratio Approach

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Abstract—This paper presents an investigation about the level of customer satisfaction at the selected bank in Indonesia on basis five dimensions of service quality. They are reliability, responsiveness, assurance, empathy, and tangible. It is noteworthy for banks to provide the high quality of service but a few of a certain bank experiencing matters on service performance which is more and more declining. Thus, some improvements should be done on each attribute that has not achieved a quality target. Taguchi Signal-to-Noise Ratio approach is applied to assess service quality performance referring to the Ordered Categorical Data obtained from the paper-based survey with distributing questionnaire containing 21 attributes. The results of this study show that there are some attributes of dimensions respectively not satisfying the quality standard of the bank. They are Rel3 attribute: customer expectation-based service) of reliability dimension, Res1: understanding needs and wants of the customers of responsiveness dimension, A1 attribute: provide a clear explanation of bank’s product to customer of assurance dimension, E1 attribute: polite and friendly staff of empathy dimension, and T1 attribute: modern looking equipment of tangible dimension.

Index Terms—Taguchi signal-to-noise ratio, service quality, customer satisfaction, bank

I. INTRODUCTION

Nowadays, in globalization era, liberalization of banking services changes a way of the banking business to satisfy the customers expectation on quality of service. According to Parasuraman et al., service quality dimension consists of reliability, responsiveness, assurance, empathy, and tangible [1]. Furthermore, it is explained there are three characteristics of service should be acknowledged for a full understanding of service quality. They are intangibility, inseparability, and heterogeneity [2]. Thus, this is critical to evaluate service of bank continuously such that customer satisfaction will be fulfilled.

The high customer satisfaction can lead to the greater customer loyalty [3] which effecting future revenue [4]. Consequently, many business organizations including bank are compelled to improve the quality of services provided based on the prior evaluation continuously.

However, the fact presented that a lot of the national banking performance in Indonesia was experiencing a decline in 2013-2016 [5]. Referring to Financial Services Authority of Indonesia in 2013 the growth of the national banks’ assets especially in Yogyakarta reached 16% but decreasing to 14% in 2014. And this condition was continuing to decline 10.6% in 2015 and 2.5% in 2016. While, mass reduction was also occurred on the credit side. It began to decline in early 2014 as much 0.8% and in 2015 was as much 10.5%. As for in 2016 declined as much 3.1%. This situation can be caused by the unstable global economy condition and a dissatisfactory bank service quality.

According to preliminary study at several competitive banks in Yogyakarta as case study showed that the level of customer satisfaction was still poor which was complaint experienced as much 16% to 37% of dissatisfaction of service. It indicated that the condition should be improved. However, what attributes of the bank service were required to be improved?

There have been many previous studies to investigate the service quality applying SERVQUAL scale in the bank such as Blanchard and Galloway [6], Newman [7], and Lau et al. [8]. They found that some limitations and inconsistencies of SERVQUAL scale were identified when assessing reliability and performance. While Shahin et al. [9], Mishra and Gangele [10], and Ho et al [11] introduced the use of Taguchi’s Signal-to-Noise Ratio scale to assess customer satisfaction of service in airport, retail outlet, and hotel. Result of their study claimed that S/N ratio provided the quality attribute improvement direction, lowering service quality variation, and improving satisfaction average. Thus, S/N ratio is better in assessing service performance than SERVQUAL scale. It is in accordance with Taguchi’s point of view stated that...
S/N ratio has ability to measure relative quality and the use of S/N ratio is simple and with additive capability [12].

Objective of this study is to analyze the customer satisfaction of the selected bank and to determine the attributes improved using Taguchi’s Signal-to-Noise Ratio.

II. RESEARCH METHOD

A. Survey

Paper-based survey was conducted in two stages. They were preliminary survey and final survey. The preliminary survey was to identify some complaints of customers in several competitive banks by distributing questionnaires. The questionnaire for preliminary survey contained 5 items of question that applied the five bank service quality dimensions, such as reliability, responsiveness, assurance, empathy, and tangible. The total respondent of preliminary survey was 90 bank customers. The final survey was conducted to investigate the service performance in the certain bank that had the largest number of complaint. The participated respondents in this final survey were 30 bank customers. Their age was in range between 17 to 60 years old who were familiar with the bank service. The questionnaire for final survey contained 21 items of question based on 21 service quality attributes, as written in Table I. The whole survey was carried out under supervision of the researcher to avoid missing data.

B. Apparatus

In this study, some equipment was used as follows:
- Statistical Package for the Social Science (SPSS) software version 23 was used to analyze and run the statistical data.
- Questionnaires was developed to identify complaints of customers in the selected bank and to investigate the service performance in the certain bank. In order to ensure the validity and reliability of the study, the questionnaire was made based on literature and a translated questionnaire was available to make sure respondents who use local language are involved without any problem.

C. Experimental Design

1) Subject of Research

The national bank is chosen as the subject of research to be analyzed on service quality, especially to the level of satisfaction about bank service and to the investigation of bank’s service performance based on customer opinion.

2) Design of Experiment

Design of experiment in this study refers to Taguchi’s Signal-to-Noise Ratio. The satisfaction data was measured in the form of Ordered Categorical Data to differentiate value of S/N ratio into the Smaller the Better, the Larger the Better, or Nominal the Best [12]. Subsequently the Larger the Better and the Smaller the Better attributes will be used to evaluate the performance of bank service quality considering the data of satisfaction and dissatisfaction of bank customer.

Based on the five service quality dimensions proposed by Parasuraman et al [1] [13], this study constructed the service quality attributes with involving 21 items of question. The attributes may be seen in Table I.

TABLE I. ATTRAIBUTES OF BANK SERVICE QUALITY

<table>
<thead>
<tr>
<th>Dimension</th>
<th>No.</th>
<th>Service Quality Attribute</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reliability</td>
<td>1</td>
<td>Accurate order fulfillment</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Accurate record</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Customer expectation-based service</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Keep services promise</td>
</tr>
<tr>
<td>Responsiveness</td>
<td>5</td>
<td>Understanding needs and wants of the customers</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>Convenient operating hours</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>Ability to solve customers’ problem</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>Attention to problems</td>
</tr>
<tr>
<td>Assurance</td>
<td>9</td>
<td>Provide a clear explanation of bank’s product to Customers</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>Easiness of access to account information</td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>Knowledgeable and experienced management team</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>Customers’ safety in their transaction</td>
</tr>
<tr>
<td>Empathy</td>
<td>13</td>
<td>Polite and friendly staff</td>
</tr>
<tr>
<td></td>
<td>14</td>
<td>Giving individual attention</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>Good communication skill with customer</td>
</tr>
<tr>
<td></td>
<td>16</td>
<td>Bank call center is easy to be reached</td>
</tr>
<tr>
<td>Tangible</td>
<td>17</td>
<td>Modern looking equipment</td>
</tr>
<tr>
<td></td>
<td>18</td>
<td>Comprehensive physical facility</td>
</tr>
<tr>
<td></td>
<td>19</td>
<td>Well-dressed employees</td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>Materials are visually appealing</td>
</tr>
<tr>
<td></td>
<td>21</td>
<td>Building is visually appealing</td>
</tr>
</tbody>
</table>

In the assessment of customer satisfaction, Likert Scale is generally used in the design of paper-based survey to prioritize the actual customer perception of service quality by level [14]. The Likert five-point scale applied in this study is consisting five level which are 1, 2, 3, 4, 5, with ’1’ standing for “strongly dissatisfied”, 5 standing for “strongly satisfied”.

The priority level data will be used to distinguish the satisfied and dissatisfied service quality performance. Define level 4 (satisfied) and level 5 (strongly satisfied) as levels of customer satisfaction about service quality; define level 2 (dissatisfied) and level 1 (strongly dissatisfied) as customer dissatisfaction of service quality attributes. Hence, the service quality attribute i’s customer satisfaction value was $s_i = y_{i4} + y_{i5}$, while the service quality attribute i’s customer dissatisfaction value was $d_i = y_{i1} + y_{i2}$. For considering the satisfied and dissatisfied information S/N ratio analysis, the satisfaction coefficient $\rho_{si}$ and the dissatisfaction coefficient $\rho_{di}$ should be calculated as shown in (1) and (2).

$$\rho_{si} = \frac{(y_{i4} + y_{i5})}{y_i}$$  \hspace{1cm} (1)

$$\rho_{di} = \frac{(y_{i1} + y_{i2})}{y_i}$$  \hspace{1cm} (2)

where, $i = 1, 2, 3, \ldots, n$ denotes n service quality attributes.

According to data conversion of (2), dissatisfaction coefficient $\rho_{di}$ was a the Smaller the Better quality
attribute, as customer dissatisfaction was not expected during the service providing process, hence the smaller dissatisfaction coefficient was the better. The satisfaction coefficient \( \eta_t \) is the Larger the Better quality attribute as larger number represented more satisfied customers. After data conversion, \( i \)-th dissatisfaction coefficient’s \( \frac{S}{N} \) ratio can be represented by (3) while \( i \)-th satisfaction coefficient \( \frac{S}{N} \) ratio was represented by (4). Equations (3) and (4) considered the differences in perception of different customers in addition to consider the average values.

\[
\frac{S}{N_i} = \eta_s = -10 \log \left( \frac{1 - \rho_s}{\rho_{si}} \right) \tag{3}
\]

\[
\frac{S}{N_i} = \eta_t = -10 \log \left( \frac{1 - \rho_t}{\rho_{ti}} \right) \tag{4}
\]

The purpose of the log functions of (3) and (4) was to transform the dissatisfaction data was applied to assess service quality attributes. Fowlkes and Creveling [16] suggested that the \( \frac{S}{N} \) has the advantage of about the service quality attributes. Fowlkes and Creveling [16] suggested that the \( \frac{S}{N} \) has the advantage of customer satisfaction of service quality attributes [15]. Meanwhile, the greater \( \eta_t \) value represented higher quality, namely, the lower customer dissatisfaction level about the service quality attributes. Fowlkes and Creveling [16] suggested that the \( \frac{S}{N} \) has the advantage of customer satisfaction of service quality attributes [15].

Therefore, when measuring two groups of data, \( i \)-th dissatisfaction coefficient's \( \frac{S}{N} \) ratio can be represented by (3) while \( i \)-th satisfaction coefficient \( \frac{S}{N} \) ratio was represented by (4). Equations (3) and (4) considered the differences in perception of different customers in addition to consider the average values.

\[
\eta_t = \eta_s + \eta_{di} \tag{5}
\]

Similarly, a greater \( \eta_i = \eta_t + \eta_{si} \) denotes better service quality of \( j \)-th attribute, therefore, this study used it to analyze the service quality attribute performance.

III. RESULT

Before analyzing the data using Taguchi \( \frac{S}{N} \) Ratio, it was necessary to conduct a validity and reliability test to measure how truthful the research results were and to measure the consistency of data over time [18]. With a significance level of 5\%, degrees of freedom (df)=n-2, or in this study df=30-2=28. The value of \( r_{table} \) can be determined from table \( r \) namely: \( df = 28, r_{table} = 0.361 \).

### Table II. VALIDITY TEST RESULT

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Attribute</th>
<th>( r_{count} )</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reliability</td>
<td>Rel1</td>
<td>0.772</td>
<td>Valid</td>
</tr>
<tr>
<td></td>
<td>Rel2</td>
<td>0.477</td>
<td>Valid</td>
</tr>
<tr>
<td></td>
<td>Rel3</td>
<td>0.606</td>
<td>Valid</td>
</tr>
<tr>
<td></td>
<td>Rel4</td>
<td>0.562</td>
<td>Valid</td>
</tr>
<tr>
<td>Responsiveness</td>
<td>Res1</td>
<td>0.672</td>
<td>Valid</td>
</tr>
<tr>
<td></td>
<td>Res2</td>
<td>0.512</td>
<td>Valid</td>
</tr>
<tr>
<td></td>
<td>Res3</td>
<td>0.730</td>
<td>Valid</td>
</tr>
<tr>
<td></td>
<td>Res4</td>
<td>0.590</td>
<td>Valid</td>
</tr>
<tr>
<td>Assurance</td>
<td>A1</td>
<td>0.443</td>
<td>Valid</td>
</tr>
<tr>
<td></td>
<td>A2</td>
<td>0.585</td>
<td>Valid</td>
</tr>
<tr>
<td></td>
<td>A3</td>
<td>0.423</td>
<td>Valid</td>
</tr>
<tr>
<td></td>
<td>A4</td>
<td>0.651</td>
<td>Valid</td>
</tr>
<tr>
<td>Empathy</td>
<td>E1</td>
<td>0.759</td>
<td>Valid</td>
</tr>
<tr>
<td></td>
<td>E2</td>
<td>0.609</td>
<td>Valid</td>
</tr>
<tr>
<td></td>
<td>E3</td>
<td>0.605</td>
<td>Valid</td>
</tr>
<tr>
<td></td>
<td>E4</td>
<td>0.361</td>
<td>Valid</td>
</tr>
<tr>
<td>Tangible</td>
<td>T1</td>
<td>0.403</td>
<td>Valid</td>
</tr>
<tr>
<td></td>
<td>T2</td>
<td>0.404</td>
<td>Valid</td>
</tr>
<tr>
<td></td>
<td>T3</td>
<td>0.454</td>
<td>Valid</td>
</tr>
<tr>
<td></td>
<td>T4</td>
<td>0.462</td>
<td>Valid</td>
</tr>
<tr>
<td></td>
<td>T5</td>
<td>0.513</td>
<td>Valid</td>
</tr>
</tbody>
</table>

To obtain an accurate result, the value of \( r_{count} \) can be obtained by using SPSS 23.0 software, the results may be seen in Table II. Based on Table II, all attributes are said to be valid because \( r_{count} \geq r_{table} = 0.361 \). Thus, there is no attribute should be removed or deleted.

For the reliability test, Cronbach's Alpha value was also calculated using SPSS 23.0. The obtained value of Cronbach's alpha for 21 items of attribute on the reliability test was 0.694. Hair et al. [19] stated that a common threshold for sufficient values of Cronbach's alpha is 0.6. Thus, the result indicated that the answers to the questionnaire items were consigned or reliable since the value of Cronbach's alpha \( \geq 0.6 \). 0.694.

The analysis result of customer satisfaction at the selected bank in Indonesia may be seen in Table III. The standard deviation was shown in the 12th (Std) column of Table III. For example, the standard deviation of accurate order fulfillment (Rel1) was 0.776. When standard deviation was used as the benchmark of comparison in the case of same total \( \frac{S}{N} \) ratio value, the smaller standard deviation represented better quality performance [20][21].

### Table III. TAGUCHI’S \( \frac{S}{N} \) RATIO ANALYSIS RESULT

<table>
<thead>
<tr>
<th>Dim.</th>
<th>Attr.</th>
<th>Service Quality Attribute</th>
<th>( y_1 )</th>
<th>( y_2 )</th>
<th>( y_3 )</th>
<th>( y_4 )</th>
<th>( y_5 )</th>
<th>( \rho_{si} )</th>
<th>( \rho_{s} )</th>
<th>( \eta_t )</th>
<th>Std</th>
<th>( R (\eta) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reliability</td>
<td>Rel1</td>
<td>Accurate order fulfillment</td>
<td>0</td>
<td>1</td>
<td>8</td>
<td>15</td>
<td>6</td>
<td>0.633</td>
<td>0.700</td>
<td>18.304</td>
<td>0.776</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Rel2</td>
<td>Accurate record</td>
<td>0</td>
<td>2</td>
<td>11</td>
<td>11</td>
<td>6</td>
<td>0.067</td>
<td>0.567</td>
<td>12.626</td>
<td>0.877</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Rel3</td>
<td>Customer expectation-based service</td>
<td>1</td>
<td>5</td>
<td>15</td>
<td>7</td>
<td>2</td>
<td>0.200</td>
<td>0.300</td>
<td>2.341</td>
<td>0.900</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>Rel4</td>
<td>Keep services promise</td>
<td>0</td>
<td>7</td>
<td>6</td>
<td>9</td>
<td>8</td>
<td>0.233</td>
<td>0.567</td>
<td>6.331</td>
<td>1.133</td>
<td>16</td>
</tr>
<tr>
<td>Responsiveness</td>
<td>Res1</td>
<td>Understanding needs and wants of the customers</td>
<td>0</td>
<td>2</td>
<td>15</td>
<td>11</td>
<td>2</td>
<td>0.067</td>
<td>0.433</td>
<td>10.296</td>
<td>0.728</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>Res2</td>
<td>Convenient operating hours</td>
<td>0</td>
<td>1</td>
<td>12</td>
<td>15</td>
<td>2</td>
<td>0.633</td>
<td>0.567</td>
<td>15.789</td>
<td>0.675</td>
<td>6</td>
</tr>
</tbody>
</table>
Meanwhile, customer satisfaction level at \( i \) attribute had \( y_i \) times of response as shown from the 4th column to the 8th column of Table III. With accurate order fulfillment (Rel1) as an example, the values of S/N ratio for 4 attributes were calculated as follows: 

\[
\begin{align*}
\eta_1 &= 10\log \left( \frac{0.067}{1-0.067} \right) = 14.624; \\
\eta_2 &= 10\log \left( \frac{0.667}{1-0.667} \right) = 14.472; \\
\eta_3 &= 10\log \left( \frac{0.467}{1-0.467} \right) = 10.881; \\
\eta_4 &= 10\log \left( \frac{0.700}{1-0.700} \right) = 1.845.
\end{align*}
\]

According to (4), calculate total performance of materials are visually appealing (T4) as example, input \( \eta_1 \) into (2) to calculate S/N ratio (\( \eta_{S1} \)),

\[
S/N_{S1} = \frac{1}{10} \log \left( \frac{0.033}{1-0.033} \right) = 14.624;
\]

input \( \eta_1 \) into (3) to calculate S/N ratio (\( \eta_{S1} \)),

\[
S/N_{S1} = \frac{1}{10} \log \left( \frac{0.067}{1-0.067} \right) = 14.472; \\
S/N_{S1} = \frac{1}{10} \log \left( \frac{0.467}{1-0.467} \right) = 10.881; \\
S/N_{S1} = \frac{1}{10} \log \left( \frac{0.700}{1-0.700} \right) = 1.845.
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S/N_{S1} = \frac{1}{10} \log \left( \frac{0.700}{1-0.700} \right) = 1.845.
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S/N_{S1} = \frac{1}{10} \log \left( \frac{0.467}{1-0.467} \right) = 10.881; \\
S/N_{S1} = \frac{1}{10} \log \left( \frac{0.700}{1-0.700} \right) = 1.845.
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S/N_{S1} = \frac{1}{10} \log \left( \frac{0.700}{1-0.700} \right) = 1.845.
\]
They are Rel3 attribute: customer expectation-based service) of Reliability dimension, Res1: understanding needs and wants of the customers of Responsiveness dimension, A1 attribute: provide a clear explanation of bank’s product to customer of Assurance dimension, E1 attribute: polite and friendly staff of Empathy dimension, and T1 attribute: modern looking equipment of Tangible dimension.

This result is in line with studies conducted by Lau et al. [8] and Felix [22] who found customer dissatisfaction on bank service quality and indicated that the investigated banks should improve the performance of several bank service quality attributes especially handle customer problems in good manner and understand specific needs of individual customers.

This study suggests that customer satisfaction can be used as an evaluation of bank service quality and performance. Thus can help bank to improve the quality of its services in order reduce dissatisfaction of actual bank service performance. This view has been supported by several other studies by Fornell et al. [23], Giese & Cote [24], and Arokiasamy & Kanesanbin [25].

V. CONCLUSION

It may be concluded as follows:

1. There are some attributes of dimensions respectively not satisfying the quality standard of bank. They are Rel3 attribute: customer expectation-based service) of reliability dimension, Res1: understanding needs and wants of the customers of responsiveness dimension, A1 attribute: provide a clear explanation of bank’s product to customer of assurance dimension, E1 attribute: polite and friendly staff of empathy dimension, and T1 attribute: modern looking equipment of tangible dimension.

2. This study found that service quality of bank has not still satisfied the customer satisfaction generally. Thus, the attributes of service quality dimensions should be improved.

REFERENCES


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