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A Model of Increasing the Service Quality of Public Transportation Based on Quality Function Deployment

Rokh Eddy Prabowo, Anwar Mansyur
Department of Management
Universitas Stikubank
Semarang, Indonesia
eddybowo@edu.unisbank.ac.id

Zulkifli Aulia Rakhman
Department of Management
Universitas Diponegoro
Semarang, Indonesia
zulkifli013@gmail.com

Abstract—This research is aimed at analyzing the priorities for the consumer's requirements of BRT Trans Semarang Corridor II in six different shelters. Ninety six respondents were selected based on the non-probability sampling with purposive sampling technique. The primary data were gathered in questionnaire, while the secondary data were collected from literary data. The research also involves some assessments supported by Public Service Agent of Trans Semarang aiming at reinforcing the assessment from the consumers. The priorities for the consumer's requirements were analyzed using Importance Performance Analysis (IPA) and Quality Function Deployment (OFD) methods. The IPA results indicate that the highest priority required by the consumers is punctuality of arrival. The OFD results show that the highest priority required by the consumers is being free from traffic jam. Differences in the results were caused by the difference in the perception made by the consumers and the management pertaining to the service quality given by BRT Trans Semarang Koridor II. Thus, BLU Trans Semarang should better the two attributes that they may develop their service quality, which is in line with the management's vision "Providing professional, independent, credible, continuous, and economical service."

Keywords—model developing; BRT; service quality; quality function deployment

I. INTRODUCTION

A. Research Background

The quality of land transportation services in urban areas must be a major concern, because this type of transportation is considered capable of breaking down congestion. Congestion is caused by the increasing number of four-wheeled and two-wheeled vehicles and people tend to use private vehicles [1]. Especially in Semarang City (BPS, 2016) in 2008 the number of four-wheeled vehicles was 20,682 units and in 2017 it was 56,453 units (an increase of 272,96 percent). In the same period the number of two wheels was 93,073 units to 252,936 units (an increase of 271.76 percent).Services are processes that consist of a series of intangible activities that usually have interactions between customers and service providers [2]. There are four characteristics of goods that distinguish between goods and services [3]. First, intangibility. Service is an act,

effort or performance. Service products cannot be seen and must be purchased first so that consumers can feel the benefits. Second, inseparability. This means that the production and consumption processes of service products occur simultaneously when consumers buy these products from service providers. Third, variability. Services are non-standardized output products, meaning services have various forms and qualities, depending on who, when and where the service is produced and used. Fourth is perishability. Services can only be consumed and the benefits enjoyed when the service is provided by the service provider. Service products cannot be stored and used at a later time, so service products can not last long.

To overcome congestion in the city of Semarang, the Semarang City Government in 2009 held a Bus Rapid Transit (BRT) called Trans Semarang. BRT is an integrated system that combines facilities, equipment and services to increase the speed and reliability of transportation. The BRT system is a form of development of the Light Rail Transit (LRT) as a fleet that runs using rubber tires, has greater operating flexibility and potentially lower costs. BRT is customer oriented to provide high quality, providing fast, comfortable and inexpensive urban mobility for the community [4]. BRT is a bus with a fast transit system with more modern services [5]. For this purpose, the Trans Semarang BRT has carried out various policies. However, there are still complaints from customers. For example in 2017 Corridor II as the most populous corridor has a load factor of 1,057.25 percent. This figure is 254.99 percent more than the Corridor I (the second most populous) which has a load factor of 803.36 percent. Corridor II services receive the most complaints from consumers with 44 complaints (BLU Trans Semarang 2018). Secondary data is supported by primary data from the results of the initial study of 10 Trans Semarang BRT passengers. Based on interviews with them, information was obtained, namely: (1) Eight passengers complained about the physical facilities of Corridor II which were still not comfortable. (2). Nine people considered Trans Semarang not on time. (3). Eight passengers felt that they lacked security guarantees. and (4). Five passengers considered that Trans Semarang officers were not friendly.

One way to improve service quality is to measure the service quality of the SERVQUAL model [3]. This model was chosen, because it covers all dimensions that will be measured the Trans Semarang BRT service consisting of tangible, reliability, responsiveness, assurance and empathy dimensions. SERVQUAL dimension is still the instrument that has received the most recognition from researchers around the world [6]. Service quality is the difference between consumer expectations and service performance. If consumer expectations are greater than service performance, then service quality is said to be bad, and vice versa [2]. Service quality can be described using the SERVQUAL model [3,6,7]. The main purpose of the SERVQUAL model is to determine the consumer's assessment of the performance of services provided by service providers to consumers. The SERVQUAL model consists of five dimensions: First, tangible, reliability, responsiveness, assurance, and empathy [8].Tangible is the feasibility of physical facilities, equipment and personnel appearance. Physical facilities are important for consumers in terms of services. In another study, it was revealed that the tangible dimension is the main focus of service to consumers that must be improved. Reliability is the ability to perform promised services reliably and accurately. This dimension is the dimension that is most considered by consumers [8]. Responsiveness is the willingness of officers to assist customers in providing fast services. Assurance is the knowledge, courtesy of employees, and the ability of service providers to inspire trust and confidence. Empathy is the individual attention given by the company to its customers. The attitude, attention and care of service providers to consumers is centered on the dimensions of empathy [9].

Therefore, the five dimensions of SERVQUAL are the framework that underlies the quality of services, and can be added with attributes and dimensions that are context-specific when needed [2,3]. To improve the results of measuring service quality with the SERVQUAL model, service quality improvement is analyzed employing *Quality Function Development* (QFD) method. QFD offers a structured approach to integrate customer requirements with product specifications and service design, through the use of graphs and matrices [10]. Integrating the SERVQUAL model into the QFD to improve the quality of Trans Semarang services Corridor II is the main objective to be achieved [11].

Based on the description, this study was given the title Quality Improvement Service Model Based on Quality Function Deployment (QFD); Case Study of Trans Semarang Corridor II. This study aims to analyze the characteristics of consumer requirements attributes in order to improve the quality of Trans Semarang BRT services Corridor II. The results of this study are expected to contribute to BLU management as managers of Trans Semarang BRT Corridor II in order to improve the quality of their services.

II. RESEARCH METHODOLOGY

A. Population, Sample and Sampling Technique

The population in this study were all Trans Semarang and Trans Central Java Bus users. The number of samples as many as 96 respondents were determined by the Slovin formula.

Determination of sampling using non probability sampling technique with purposive sampling method. Those who were respondents were Trans Semarang Corridor II service users and had used Trans Central Java public transportation services.

B. Data, Resource and Data Retrieval Techniques

There are two types of data needed in this study, namely: primary data and secondary data. Primary data comes from respondents and collected by questionnaire method. Secondary data is collected from BLU, BPS, and other sources by literature reviews.

C. Instrument for Data Analysis

The data that has been collected was processed using the QFD and IPA Method.

1) Quality function deployment method: QFD is the first method developed in Japan by Yoji Akao in 1966. QFD was created to help businesses in transforming consumer valuations into technical characteristics of a product. The main objective of the QFD is to ensure that the actual needs of consumers are precisely listed throughout the design, manufacture and delivery of products, and to improve the product development process itself. QFD provides a means to translate customer requirements into technical requirements in accordance with the stages of product development and production [12]. The entire QFD procedure uses a matrix called a house to express the relationship between input and output. House of Quality as the first matrix of the company can achieve various benefits [13].

House of Quality (HoQ) or home quality is the initial stage in the application of the QFD method. Basically, the quality house matrix tries to translate directly the consumer's assessment of the technical preconditions of a product or service produced. The quality house has six parts that represent each stage in its formation. These stages are as follows:

a) Voice of customer: In this step the company tries to find out all the prerequisites or demands of consumers related to the product.

b) Competitive analysis: In this section, service providers analyze consumer desires and needs based on product characteristics and competitor products for all quality dimensions stated.

c) Voice of organization: This section aims to identify technical characteristics related to service provider responses to consumer desires.

d) Design targets: Describe what relationships are elevated by consumers with technical needs.

e) Relationship matrix: The last second part of quality homes aims to assess what relationships are desired by consumers with technical needs.

f) Correlation matrix: This section aims to conduct a correlation analysis that shows the relationship between technical needs.

There are six benefits of using the QFD method [8], as follows: First, help the company in making trade-offs between what the customer demands and what the company produces. Second, increase teamwork among experts in the company. Third, increasing customer satisfaction (this is done by considering customer needs and bringing customers into the product development process). Fourth, shorten the duration of delivery time to consumers. Fifth, causing employees to provide sufficient documentation, because employees see the importance of information. Sixth, improve effective communication between company divisions.

Before being processed with this method, a House of Quality (HoQ) matrix had to be created. This matrix functions as a translator of consumer desires (voice of customers) into the customer requirements (customer requirements) and controls the company's efforts in meeting the intended requirements.

To make HoQ, there are six stages that must be done, namely: (1). Preparing customer requirements, (2). Developing a planning matrix, (3). Compiling technical responses, (4). Developing a relationship matrix, (5). Develop a technical correlation matrix, and (6). Develop a technical matrix.

2) Importance-performance analysis method: Based on the data in the Technical Matrix, the value of the customer's interest is determined by using the Importance Performance Analysis (IPA) method. Each customer requirements attribute will be mapped into the IPA diagram based on the customer's importance value and the current performance value of each attribute. The IPA diagram is a scatter plot diagram constructed by the X axis (representing performance) and the Y axis (representing interests). IPA was first developed by Maritlla and James in 1977 with the aim of measuring the level of client satisfaction with a product or service [14].

In detail, the attributes of customer requirements and the attributes of the technical responses are presented in the following table:

TABLE I.   CUSTOMER REQUIREMENTS ATTRIBUTES

No	Customer Requirements Attributes	Dimensions
1	Cleanliness in bus stops and fleets	Tangible
2	Cool air temperature	
3	Shelters can protect passengers from hot and rainy weather	
4	Comfortable seating facilities	
5	Fleet has multimedia facilities that are entertaining and sophisticated	
6	Attractive fleet appearance	
7	The clerk has a pleasant appearance	
8	Fast fleet arrival time lag	Reliability
9	There is a definite arrival schedule	
10	Free of congestion	

Table 1. Cont.

No	Customer Requirements Attributes	Dimensions
11	Fleet is reliable and does not strike	
12	Fast transit time when crowded with passengers	
13	Fast transit time when crowded with passengers	
14	Official page that contains complete information	
15	Information services through social media	Responsiveness
16	There is a real time online complaints service	
17	There is information on the telephone number of the Trans Semarang hotline at each stop	
18	Passengers in the fleet know who is responsible for the trip	
19	Ease of accessing information from officers	
20	Driver drives safely and recklessly	Assurance
21	The presence of security officers at each bus stop	
22	Accident insurance	
23	There is a fire extinguisher in the fleet	
24	Friendly clerk	Empathy
25	Officers communicate in polite language	
26	Officers are always ready to help the special needs of passengers	

TABLE II.   CUSTOMER REQUIREMENTS ATTRIBUTES

No	Technical Responses Attributes	Dimensions
A	Headway Plan	Reliability
B	Time to Raise and Lower Passengers	
C	Distance between bus doors and shelters	
D	Travel Speed	
E	Fleet reliability	
F	Consistency of Service Hours	
G	Shelter Security	Security
H	Bus security	
I	Safety at Shelter	
J	Safety on the Bus	
K	Ease of getting information	Easy
L	Ticket sales speed	
M	Ease of reporting loss / finding items	
N	Ease of submitting complaints, giving advice	
O	Ease of access to / from the shelter	
P	Cleanliness in the Shelter	Comfortable
Q	Lighting in the Shelter	
R	Passenger density inside the Shelter	
S	Cleanliness on the bus	

Table 2. Cont.

No	Technical Responses Attributes	Dimensions
T	Lighting on the bus	
U	Passenger density on the bus	
V	The temperature inside the bus	
W	Driver reliability	

III. FINDINGS AND DISCUSSION

A. Description of Respondents

Based on gender, female respondents were 67 percent, while male respondents were 33 percent. The highest age group of BRT passengers is 15-25 years (71 percent), age groups 26-35 years and 35-45 years respectively 9.0 percent, age groups over 45 know as much as 8.0 percent, and age groups in under 15 years only 2.0 percent.

Viewed from the point of view of employment, as many as 60 percent of students / students, as private employees as much as 24 percent, as civil servants as much as 5.0 percent, as entrepreneurs as much as 4.0 percent, and 6.0 percent only claimed other jobs.

The number of respondents based on income level is grouped into five groups, namely groups of less than IDR 500,000 as much as 24 percent, between IDR 501,000 - IDR 1,000,000 as much as 39 percent, between IDR 1,001,000-IDR 2,500. 000 as much as 24 percent, between IDR. 2,501,000 - IDR. 5,000,000 as much as 13 percent, and those who earn more than IDR. 5,000,000 as much as 4.0 percent.

Based on this description there appears to be a tendency, that increasing age and income above IDR 2,500,000 are fewer and fewer who are passengers of the BRT of Trans Semarang Corridor II. They may have switched from Trans Semarang BRT passengers to private vehicles; both two wheels and four wheels. If this is proven, then the purpose of holding BRT to break down congestion will not be realized. In other words, congestion will continue to occur and can be made worse, because people who earn more than IDR 2,500,000 are on the Trans Semarang BRT.

B. The Results of QFD Analysis

Based on the results of QFD analysis found the value of raw weight normalized each customer requirements from the most to the least. In this study there are 26 customer requirements, but in this paper only displays 10 requirements customers must get serious attention from Public Service Agent Trans Semarang. Showing the 10 customer requirements in this paper does not mean that the remaining customer requirements are ignored by Public Service Agent. The ten customer requirements attributes are presented in Figure 1.

Based on the 10 attributes of customer requirements, customers' desires appear, namely: safe, comfortable and timely. This is consistent with the BRT embryo in Indonesia by Trans Jakarta, namely creating a comfortable, fast and humane

mass public transport reform in Indonesia. The fulfillment of these customer requirements by BLU can have a positive and significant impact in the medium and long term, because the attributes of these requirements are conveyed by those aged 15-25 years and still as students. Their number is 71 percent of the total number of Trans Semarang BRT passengers.
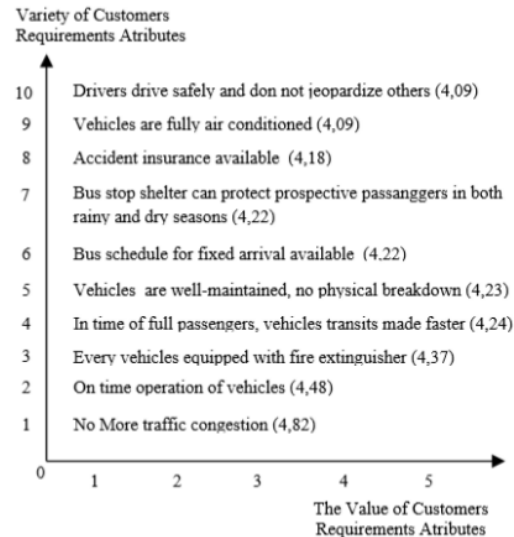

Fig. 1. REZ curve a model for improving the services quality of BRT Trans Semarang.

C. The Findings of IPA Analysis

The results of the IPA analysis are shown in Diagram 1. This diagram contains a distribution of 36 consumer requirements attributes (attached). The distribution is as follows.
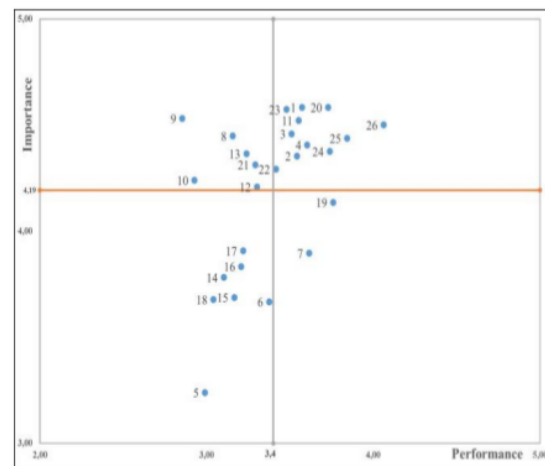

Fig. 2. Diagram of customer requirements atributes.

In Figure 2 shows there are four quadrants, namely: Q1 (Concentrate Here), Q2 (Keep Up the Good Work), Q3 (Low Priority), and Q4 (Possible Overkill). Quadrant Q1 and Q2 show interest, while Quadrant Q3 and Q4 show Performance. The intersection points of the X and Y axes are at coordinates 3.4, 4.14.

In Q1 (Concentrate Here) there are six attributes, namely attributes 8, 9, 10, 12, 13, and 21. In Q2 (Keep up the Good Work) there are 10 attributes, namely: attributes 1, 2, 3, 4, 11, 20, 22, 23, 24, 25, and 26. In Q3 (Low Priority) there are seven attributes, namely attributes 5, 6, 14, 15, 16, 17, and 18. As for Q4 (Possible Overkill) there are only two attributes, namely attribute 7 and attribute 9.

Based on the distribution of the above attributes, there is one attribute located in the upper leftmost coordinate in Q1 (Concentrate Here) which is attribute 9 which reads "There is a definite arrival schedule". This position has a meaning, that the attribute is the highest priority needed by Trans Semarang BRT consumers. Therefore, in an effort to improve the quality of service, BLU must be consistent to realize the arrival of the Trans Semarang BRT fleet in accordance with the schedule.

The accuracy of the fleet arriving at a bus stop is a certainty that must be given by the BLU to the customers of Trans Semarang BRT. This certainty will have a direct impact on time management by consumers in preparing themselves to get the fleet needed. Eventually consumers can determine the arrival time at their destination. If this condition can be felt by consumers, then the purpose of the Trans Semarang BRT to break down congestion is likely to become a reality.

These demands are very reasonable, because basically the BRT concept is a concept of mass transportation that provides high quality, fast, comfortable and inexpensive urban mobility for the community [14]. The main characteristic of the BRT system are: (1). the process of going up and down passengers from fast vehicles and (2). A clean, safe and comfortable bus stops.

IV. CONCLUSION

Trans Semarang Public Service Agency can increases its services to the passengers by improving arrival schedule, fast fleet arrival time lags, fleet operates on time as promised, the presence of security officers at each stop, and fast transit times when there are passengers. Those information will contribute to the high level services to the passengers so that most of the people in City of Semarang will move to the public transportation especially Trans Semarang. Beside the result implication, further research is recommended to integrate the Quality Function Deployment method with the Kano model.

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