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PERFORMANCE OPTIMIZATION OF BUS RAPID TRANSIT IN THE CITY OF JOGJA

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ABSTRACT

Indonesia is one of the countries categorized as developing countries with increasing demand for transportation, in which the people prefer using private transportation for its convenience and punctuality. Meanwhile, one of the efforts to overcome the problem with public transportation is by operating *Bus Rapid Transit* (BRT). Indeed, Jogja has a BRT called Trans Jogja. The implementation of *Bus Rapid Transit* (BRT) itself requires a performance evaluation, by exploring the service quality. Strategic priorities for the implementation of *Bus Rapid Transit (BRT)* management are needed in optimizing the performance of BRT in Jogja. The findings of this study reveal that the better the management of BRT is, the more the performance of BRT will directly improve. The better the policy of BRT is, the more the performance of BRT will directly improve. The better the quality of BRT management is, the more the quality of BRT service will directly improve. The better the policy of BRT is, the more the quality of BRT service will directly improve. Improving the quality of BRT management and policy will directly enhance the performance of BRT and indirectly will affect the improvement of the service quality.

Keywords: transportation, trans jogja bus, BRT management.

INTRODUCTION

Indonesia is one of the countries categorized as developing countries with increasing demand for transportation. The number of people moving or being mobile using private transportation and those using public transportation is not sufficiently balanced so that transportation problems in Indonesia are quite difficult to solve. Today's lifestyle has actually created a higher dependence on cars and reduced the need for mass transit. The main factors determining the decline of public transport users are the prosperity of the people, the car availability that continues to get better, the desire to have a house in quiet areas, and the government's policies related to housing and road developments that indirectly encourage the use of private cars [1].

Urban problems in Indonesia generally include rapid population growth, extremely high increase of private vehicles, the increase of BBM (fuel) use, increased air pollution, supply and demand imbalances, mismatch between modes of transport, high rates of accidents and low mobility efficiency due to the use of land that is not supporting. The policy of urban public transport is illustrated with the development of public transport modes such as buses called BRT.

In its implementation, *Bus Rapid Transit* (BRT) needs a performance evaluation, by exploring the service quality. Since the quality of the service is important for the success of Trans Jogja, this study is then conducted in one of BRT organizers, which is Jogja.

The province of DIY (The Special Region of Yogyakarta) comprises 4 regencies (Sleman, Bantul, Gunung Kidul, Kulon Progo) and 1 city (Yogyakarta). Urban agglomeration of Yogyakarta area covers all of Yogyakarta city, part of Sleman Regency and Bantul Regency. The condition and the performance of urban public transport are getting worse; the average LF in 2004 was only 27.22%. Trans Jogja is a *Bus Rapid Transit* operatingin the city of Jogja. Based on the Department of Transportation (KOMINFO) 2010, there are several problems related to the implementation of Trans Jogja bus, which are the lack of bus stops, which are too far for the passengers to reach the shelter, the complaints from the users or passengers against the service of Trans Jogja bus, and the placement of the bus stop that is quite dilemmatic between the needs and the constraints; i.e. on the one hand, people need it but on the other hand, it is rejected by those who feel that their activities are disrupted.

This study is aimed at investigating the strategic priorities of the implementation of *Bus Rapid Transit (BRT)* management in Jogja.

DEFINITION OF BUS RAPID TRANSIT

Bus Rapid Transit (BRT) or busway is a high quality bus based on fast, convenient, and low cost transit system for urban mobility by providing pavements for pedestrians, infrastructures, fast and frequent service operations, marketing benefits and distinctions as well as services to the customers. *Bus Rapid Transit* (BRT) basically emulates the performance characteristics of the modern rail transport system. One BRT system will usually cost 4-20 times less than Light Rail Transit (LRT) and 10-100 times less than the subway train system.

The term BRT has emerged from its implementation in North America and Europe. However, this concept is also transmitted through the world under different names, such as:

a) High - Capacity Bus Systems
b) High - Quantity Bus Systems
c) Metro - Bus
d) Surface Metro
e) Express Bus Systems
f) Busway Systems.

Although the term varies from country to country, it has the same basic principles, such as: the service quality of the vehicles that compete with other public transport at affordable cost. For convenience, the term BRT or bus way will be used frequently in describing this system. However, it is acknowledged that this concept and system will undoubtedly keep developing. Some literature that can help explain BRT's definitions is as follows:

"*Bus Rapid Transit* (BRT) is a flexible mode with rubber tires that has quick transits and combines station (bus stop), vehicles, services, roads and *Intelligent Transportation System* (ITS) element in an integrated system with strong identity [2].

METHODS

Analysis Method of Quality Function Deployment (QFD)

QFD method aims to get priorities for service attributes and technical responses from the users of *Bus Rapid Transit*by creating house of quality. Before QFD analysis, IPA is firstly done.

A) The application of research variables

The research variables are used to learn the types of services, regulations, policies, and the facilities of *Bus Rapid Transit* in Jogja, Solo, and Semarang.

B) Research samples

The research sample used is *Disproportioned Stratified Random Sampling,* in which the samples are taken randomly from the whole population and stratified even though some of the divisions are less proportional [3].

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C) Creating Research questionnaires

Questionnaires as an instrument of data collection are created based on literature reviews and the needs of the users, which are collected through preliminary survey. The questionnaires are in the forms of question items comprising BRT's service attributes with Likert scale, as the followings:

a) = Not satisfactory
b) = Less satisfactory
c) = Fairly satisfactory
d) = Satisfactory
e) = Very Satisfactory.

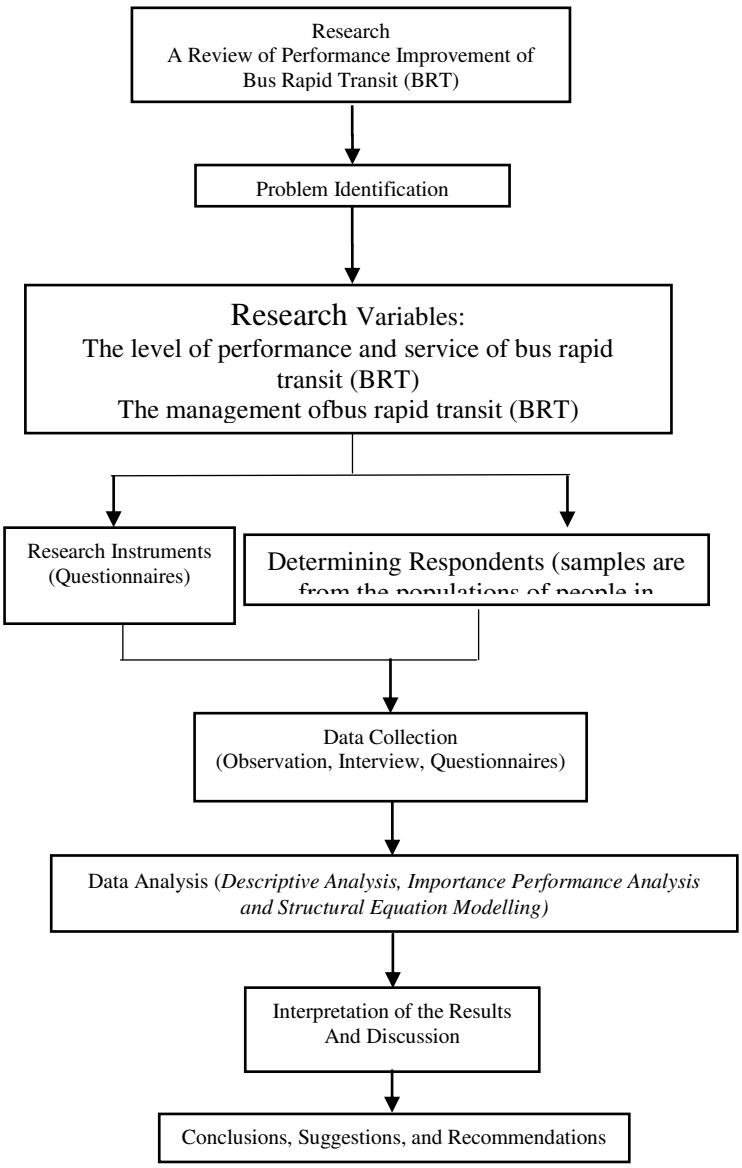
D) Testing the correlation and the consistency in building the house of quality

a. Correlation test

Correlation test is done to investigate the validity of the questionnaires that will be distributed to the people in the research samples. This test is done to 30 people [4].

b. Consistency test

Consistency or reliability test is done after correlation test. Consistency test aims to investigate whether or not the instruments for data collection basically show their levels of precision, accuracy, stability or consistency in revealing certain symptoms of a group of individuals, albeit conducted at different times. Reliability test is done to questions or statements that have been proven valid. To test *internal consistency*, consistency coefficient (*Cronbach's alpha)* is used.



Source: Personal documents

Figure-1. Flow chart of the Research.

FINDINGS AND DISCUSSIONS

The Results of Analysis and Improvement of BRT with QFD method

The determination of improvement variable in this research can be done by using analysis tools of*Quality Function Deployment* (QFD). This QFD analysis process uses the results of IPA analysis that has been previously conducted. The purpose of this analysis is to define and determine the targets of improvement on one quality of *Bus Rapid Transit* (BRT) service by measuring the value of *Own Performance* (OP) or technical responses from the management.

The stages of this analysis are, first, determining the order of difference of the existing variables (GAP). After GAP analysis is done using *Service Quality*, the analysis of*Quality Finction Deployment*is then conducted in the next step.One of the important things in QFD is*House of Quality* (HoQ). The stages in making HoQ are:

a) Creating*Voice of Customer*
b) Creating a planning matrix
c) Creating *Technical Responses*

Bus Rapid Transit (BRT) in the city of Yogyakarta

A. The analysis of voice of customer

In the analysis of Service Quality above, it has been concluded that there are several attributes that become the priority based on the order of difference (Gap)

starting from the biggest to the smallest in improving the service quality of *Bus Rapid Transit* (BRT).The following table shows the service attributes with high priorities (quadrant I) in order based on the results of data processing using QFD analysis:

Table-1. Data of voice of customer of bus rapid transit in Yogyakarta.

Priorities for BRT service attributes
BRT waiting time
BRT operational time
Health relief measures
Getting the transport needed after using BRT
The information on BRT integration to the destination locations
The officers are polite and friendly, as well as well-groomed in giving the service
Ticketing service
Transport service time

Source: The Results of Analysis, 2016

B. The analysis of planning matrix

The next step in designing *House of Quality*is the planning matrix. This analysis refers to the value of expectation and satisfaction as follows:

Table-2. The analysis of planning matrix.

Voice of customer	Customer expectation values	Customer satisfaction values
BRT waiting time	3.6	3.19
BRT operational time	3.85	3.09
Health relief measures	3.78	3.12
Getting the transport needed after using BRT	3.98	3.3
The information on BRT integration to the destination locations	3.8	3.16
The officers are polite and friendly, as well as well-groomed in giving the service	3.94	3.22
Ticketing service	3.81	3.3
Transport service time	3.87	3.29

Source: Results of Analysis (2016)

There are seven sections in the planning matrix, namely:

a) Importance of Customer (IoC)

The value of*Importance of Customer*is obtained from the goal achieved from the average level of expectation divided by the total of all expectation values in each attribute of *Voice of Customer* (VoC). For example, the calculation of IoC on attribute number 1 resulted in an obtained goal of 3.6. Meanwhile, the overall total of the goal values is 30.63. Thus:

$$IoC = \frac{Goal}{Total\ Goal} = \frac{3.6}{30.63} = 0.117$$

b) Customer satisfaction performance

It is the value of the passengers' perception of how well the services of the alloying mode terminal meet the passengers' needs. The passenger satisfaction level is obtained from the average perception values. The following table shows the complete calculation results of the passenger satisfaction (perception) level:

Table-3. The values of customer satisfaction performance of BRT in Yogyakarta.

Service attributes	The Values ofcustomer satisfaction performance
BRT waiting time	3.19
BRT operational time	3.09
Health relief measures	3.12
Getting the transport needed after using BRT	3.3
The information on BRT integration to the destination locations	3.16
The officers are polite and friendly, as well as well-groomed in giving the service	3.22
Ticketing service	3.3
Transport service time	3.29

Source: Results of analysis (2016)

c) Goal

It is the value of the passengers' expectation of the services of the alloying mode terminals in meeting the customers' needs. The passenger goal level is obtained from the average expectation values. The following table shows the complete calculation results of the passengers' expectation level:

Table-4. The values of *Goal*of BRT in Yogyakarta.

Service attributes	The values of goal
BRT waiting time	3.6
BRT operational time	3.85
Health relief measures	3.78
Getting the transport needed after using BRT	3.98
The information on BRT integration to the destination locations	3.8
The officers are polite and friendly, as well as well-groomed in giving the service	3.94
Ticketing service	3.81
Transport service time	3.87

Source: The Results of Analysis (2016)

d) Improvement ratio

It is a measure of the efforts required to change the passengers' satisfaction level in the existing conditions of the customer attributes to achieve the desired goals. The example of the calculation for *improvement ratio*on attribute number 1 is:

$$\text{Improvement Ratio} = \frac{\text{Goal}}{\text{CSP}} = \frac{3.6}{3.19} = 1.128 \quad (1)$$

Notes:

CSP = Customer Satisfaction Performance

e) Raw weight

*Raw weight*is a value describing the overall importance level of each passenger's need based on the importance level for the passengers (Important to Customer) and Improvement Ratio. The example of the calculation for attribute number 1 is:

Raw Weight = (Importance of Customer) x (Improvement Ratio) (2)
= 0.117 x 1.128= 0.132

f) Normalized raw weight

Normalized raw weightis theraw weight expressed in percentage or fractions between 0 and 1. The example of the calculation for attribute number 1 is:

Normalized Raw Weight = 0.132 = 13.2%. (3)

Table-5. Planning submatrix of house of quality of BRT in Yogyakarta.

Improvement Ratio	Raw Weight	Raw Weight Percentage	Cummulative Normalized Weight	Goal	Customer Satisfaction Performance	Importance to Customer (IoC)
1.1285	0.133	0.133	0.133	3.6	3.19	0.1175
1.2460	0.157	0.157	0.289	3.85	3.09	0.1257
1.2115	0.150	0.150	0.439	3.78	3.12	0.1234
1.2061	0.157	0.157	0.595	3.98	3.3	0.1299
1.2025	0.149	0.149	0.745	3.8	3.16	0.1241
1.2236	0.157	0.157	0.902	3.94	3.22	0.1286
1.1545	0.144	0.144	0.739	3.81	3.3	0.1244
1.1763	0.149	0.149	0.888	3.87	3.29	0.1263

Source: The results of analysis (2016)

g) Determining technical responses

Technical Responsesis the answer of Voice of Customercreated by the management or the researcher to realize the customers' needs. After the analysis is done by the technical teams and assisted by the department of transportation as the manager, some technical responses of BRT in Yogyakarta are obtained as follows:

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Table-6. Data of technical responses of BRT in Yogyakarta.

No.	Technical responses
1	Adjustment and more departures of BRT.
2.	The improvement of the officers' skills and capabilities.
3	The improvement of BRT integration with other transportations.
4	Adding more route information boards.
5	The improvement of ticketing service system.

Source: The Results of Analysis (2016)

C. The analysis of relationships

It is an assessment of the power of the correlation between each element of technical response in "Hows" with each voice of customer. The filling of this submatrix is very important when determining the priorities of the taken actions.

D. Technical correlations

The function of technical correlationsis to know the extent of the correlations between technical responses, whether the correlation is positive or negative.

E. Technical matrix

In this sub-section, the authors set targets to develop the services of the mode alloying terminals of BRT in Yogyakarta andprovide a priority order for attributes in the technical responses. The following figure is the technical matrix that the authors made.

Technical Benchmarking	BRT operational time starts from 4 a.m. to 9 p.m. Western Indonesian Time	Trainings for the officers regarding health relief measures and the officers' skills	Adjusments of the schedules and the routes with other public transports	Adding more route information boards at BRT bus stops	Using online ticketing system and improving the location of ticket sales
Absolute Importance	97.20	68.40	64.80	32.40	32.40
Percent Importance	33%	23%	22%	11%	11%

Source: Results of analysis (2016)

Figure-2. Technical matrix of BRT in Yogyakarta.

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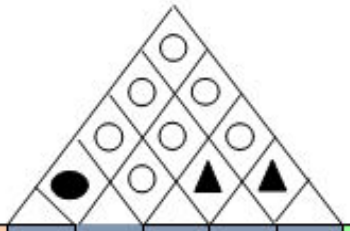

WHATs	Customers' Expectations	Adjustment and more departures of BRT.	The improvement of the officers' skills and capabilities.	The improvement of BRT integration with other transportations.	Adding more route information boards.	The improvement of ticketing service system.	Improvement Ratio	Raw Weight	Raw Weight Percentage	Cummulative Normalized Weight	Goal	Customer Satisfaction Performance	Importance to Customer (IoC)
BRT waiting time	5.6	9	0	0	0	0	1.1265	0.155	0.155	0.155	5.6	5.10	0.1175
BRT operational time	5.65	9	0	0	0	0	1.2460	0.157	0.157	0.289	5.65	5.09	0.1257
Health relief measures	5.75	0	9	0	0	0	1.2115	0.150	0.150	0.439	5.75	5.12	0.1254
Getting the transport needed after using BRT	5.95	0	0	9	0	0	1.2061	0.157	0.157	0.595	5.95	5.5	0.1299
The information on BRT integration to the destination locations	5.5	0	0	9	9	0	1.2025	0.149	0.149	0.745	5.5	5.16	0.1241
The officers are polite and friendly, as well as well-groomed in giving the service	5.94	0	9	0	0	0	1.2256	0.157	0.157	0.902	5.94	5.22	0.1288
Ticketing service	5.61	0	1	0	0	9	1.1545	0.144	0.144	0.759	5.61	5.5	0.1244
Transport service time	5.67	9	0	0	0	0	1.1765	0.149	0.149	0.908	5.67	5.29	0.1265
TOTAL VALUES	50.63	27	19	18	9	9	9.5491	1.194	1		50.63	25.67	1.00
Contribution		27	19	18	9	9	82						
Normalized contribution		32.9%	23.2%	22.0%	11.0%	11.0%							
Priority		1	2	3	4	5							
Technical Benchmarking		BRT operational time starts from 4 a.m. to 9 p.m. Western Indonesian Time	Trainings for the officers regarding health relief measures and the officers' skills	Adjustments of the schedules and the routes with other public transports	Adding more route information boards at BRT bus stops	Using online ticketing system and improving the location of ticket sales							
Absolute Importance		97.20	68.40	64.80	32.40	32.40							
Percent Importance		33%	23%	22%	11%	11%							

Source: The Results of Analysis (2016)

Figure-3. House of quality of BRT service in Yogyakarta.

CONCLUSIONS AND SUGGESTIONS

Conclusions

a) The better the management of BRT is, the more the performance of BRT will directly improve.
b) The better the policy of BRT is, the more the performance of BRT will directly improve.
c) The better the quality of BRT Management is, the more the quality of BRT service will directly improve.
d) The better the policy of BRT is, the more the quality of BRT service will directly improve.
e) Improving the quality of BRT management and policy will directly enhance the performance of BRT and indirectly will affect the improvement of the service quality.

Suggestions

It is recommended that further research on the review of BRT performance improvement is conducted in all areas of Indonesia that provide BRT as a facility of mass public transport so that it can be used as the guidelines for the implementation of BRT in Indonesia.

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