

Evaluation of performance and service quality of Trans Bandung Raya Bus (case study: route of Elang Terminal – Jatinangor Terminal)

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Abstract. Land transportation needs are increasing. One of the problems is the uncontrolled number of private vehicles. Buses as public transportation become the right choice to overcome the problem. Bus rapid transit is a fast, convenient, secure and punctual. The research purpose is to know the performance of Trans Bandung Raya Bus (TBRB) based on the policy of Director General of Land Transportation Decision No.SK.687/AJ.206/DRJD/2002 and to analyze the service quality factors of TBRB. The method of service quality assessment is Importance Performance Analysis. The research showed that the total value of TBRB's performance is 23 and based on the performance standards of the Director General of Land Transportation Decision is the "Good" category. The value of TBRB service quality (2.63) is smaller than the expected value (3.31) which means that TBRB have to keep improving their performance. The service quality variables that need to be improved are Empathy and Assurance.

1 Introduction

Currently, the number of residents in West Java, especially the city of Bandung, continues to increase in line with the increase in the economy. This resulted in the transportation need, especially land transportation is increasing and this causes the movement of vehicular traffic increased rapidly, resulting in various problems of land transportation such as traffic congestion. One of the problem causes is the number of private vehicles increasing significantly. This is because people prefer to use private vehicles as a mode of transportation due to aspects of time schedule, comfort and security. The best solution to overcome this problem is the Government together with Private Parties should continue to improve the quantity and quality of public transportation, including Bus.

Bus rapid transit (BRT) is a bus management system with characters: fast, convenient and secure, and timely in terms of schedule. Bus rapid transit (BRT) is used as an alternative of transportation because it has better service quality than other buses system. In the BRT system, passengers up and down are done quickly at the bus stop, thus saving travel time, which ultimately improves the quality of bus services. Currently, Bandung is one of the cities that have Bus Rapid Transit (BRT), one of which is Trans Bandung Raya

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Bus (TBR). Bus TBR operation needs to be improved steadily, because it is not functioning optimally yet. Therefore, the researcher conducted a case study at route of Elang Terminal (Bandung City) to Jatinangor Terminal (Bandung District).

2 Performance

Performance is the ability or potential of public transportation to serve the needs of movement in an area, either in the form of transportation of goods and transportation of people (human) [1]. Performance is also the level of achievement or the work of the company of the goals to be achieved/tasks that must be implemented within a certain time [2].

2.1 Performance of public transport

The performance parameters of public transport are based on the Decision of the Director General of Land Transportation [3] is as follows:

Travel Time: Travel time is used to measure the travel time of a public transport for mileage per kilometer. Travel time can be calculated using equation as follows:

$$W = \frac{T}{J} \quad (1)$$

where, W is traveling time of public transport in minutes/km, T is the distance between segments in km and J is traveling time of public transport in minutes.

Travel speed: The speed of the urban public transport journey is the ratio of the operating distance to the travel time required by the transport in carrying out its service operation. The equations used in measuring travel speed as follows:

$$V = \frac{60J}{T} \quad (2)$$

where, V is traveling speed of public transport in km/hour, J is the distance of public transport routes in km and T is traveling time of public transport in minutes.

Load factor: Load factor is the ratio of the number of passengers with the capacity of the seat per unit of time. The limit of ideal load factor is < 70% (KM 35 of 2003). To determine the load factor used the following formula:

$$Lf = \frac{JP}{C} \times 100\% \quad (3)$$

where, Lf is the load factor (%), JP is the number of passengers / public vehicle and C is the passenger capacity / public vehicle.

Time of service or hours of operation: Service time is very influential on the acquisition of rit in one day, the operational cost, income and services of public transport provided to the community.

Circulation time: Circulation time is the time required by the city transport to undergo a round or two route rit from the original terminal back to the original terminal. The formula is used as follows:

$$CT_{ABA} = (T_{AB} + T_{BA}) + (\sigma_{AB} + \sigma_{BA}) + (T_{TA} + T_{TB}) \quad (4)$$

where, CT_{ABA} is the circulation time from A to B then return to A, T_{AB} and T_{BA} are average travel time from A to B and from B to A, σ_{AB} and σ_{BA} are the travel time

deviation from terminal A to terminal B and from terminal B to terminal A, T_{TA} and T_{TB} are the stop time at Terminal A and Terminal B.

Frequency of service: Frequency is the number of vehicles that operate within one hour. Frequency calculation using the following formula:

$$f = \frac{N}{60} \tag{5}$$

where, f is the frequency of the number of vehicles per minute and N is the number of vehicles.

Time between vehicles (headway): Headway is the time interval between a public transport vehicle and the next public transport vehicle that must go through a certain point. The headway value is calculated by the following equation:

$$H = \frac{60}{f} \tag{6}$$

where, H is the time between vehicles in minutes and f is the frequency of service in vehicle per hour.

Waiting Time: Waiting time is the stop time of public transport at the origin or destination, the public transport waiting time can be calculated from half of Headway.

2.2 Standard appraisal of public transport performance

The performance appraisal of public transport uses the indicators and standard of value published by the Ministry of Transportation as follows [4]:

Table 1. Performance indicators of public transport

NO	INDICATOR	UNIT	ASSESSMENT STANDARD		
			NOT GOOD (1)	MODERATE (2)	GOOD (3)
1	Load factor, busy hour	%	> 100	80 – 100	< 80
2	Load factor, no busy hour	%	> 100	70 – 100	< 70
3	Travel speed	Km/hour	< 5	5 – 10	> 10
4	Headway	Minutes	> 15	10 – 15	< 10
5	Time travel	Minutes/km	> 12	6 – 12	< 6
6	Service time	Hour	< 13	13 – 15	> 15
7	Frequency	Vehicle/hour	< 4	4 – 6	> 6
8	Number of vehicles operating	%	< 82	82 – 100	100
9	Waiting time	Minutes	> 30	20 – 30	< 20
10	Start and end time of trip	Time	05.00 - 18.00	05.00-20.00	05.00 >20.00

Source: Director General of Land Transportation 2002 in Marsudi [4]

Total performance value of public transport is categorized according to the standard in the following table [4]:

Table 2. Standard appraisal of public transport performance

CATEGORY	TOTAL VALUE
Good	18,00 - 24,00
Moderate	12,00 - 17,99
Not good	< 12

Source: Director General of Land Transportation 2002 in Marsudi [4]

2.3 TBR Bus Demand

The number of Bus TBR demand at any time of circulation can be estimated by the following equation:

$$K = \frac{CT_{ABA}}{H \times fA} \times 100\% \tag{7}$$

$$H = \frac{60 \times C \times Lf}{P_{maks}} \tag{8}$$

where, K is the number of vehicles per circulation time, CT_{ABA} is the circulation time in minutes, H is the time between vehicles, fA is the vehicle availability factor (100%), Lf is the load factor (used 70%), C is the passenger capacity of vehicle and P_{maks} is the maximum number of passengers

Number of TBR Bus needed in the busy time period is calculated by the following equation:

$$K' = K \times \frac{W}{CT_{ABA}} \tag{9}$$

where, K' is the number of vehicles busy time period, K is the number of vehicles per circulation time, W is busy time period in minutes and CT_{ABA} is circulation time in minutest.

3 Importance Performance Analysis (IPA)

Importance Performance Analysis (IPA) was formulated by John A. Martilla and John C. James [5] is a descriptive statistical method for measuring a person's level of satisfaction over the performance of others. Person satisfaction is measured by comparing the level of expectations / importance with perception / performance (Gap Analysis). If the expectation level is higher than perception, it means that the consumer has not reached satisfaction, or vice versa. The results of the analysis are set forth in a Cartesian diagram of Martilla [5], as follows:

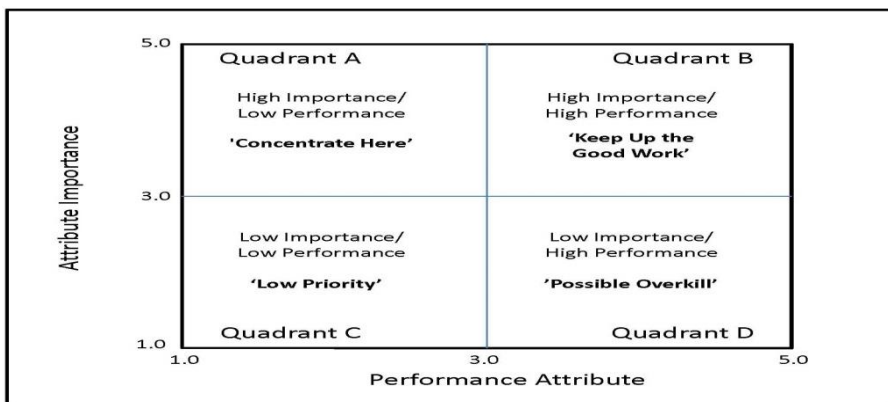


Fig. 1. Importance – Performance matrix (adapted from Martilla and James [5])

Quadrant A: aspects require immediate attention for improvement and are major weaknesses. Quadrant B: aspects indicate opportunities for achieving or maintaining competitive advantage and are major strengths. Quadrant C: aspects are minor weaknesses and do not require additional effort. Quadrant D: aspects indicate that business resources committed to these attributes would be overkill and should be deployed elsewhere”.

4 Methodology and result

The structure of the research framework can be seen in Figure 2 below

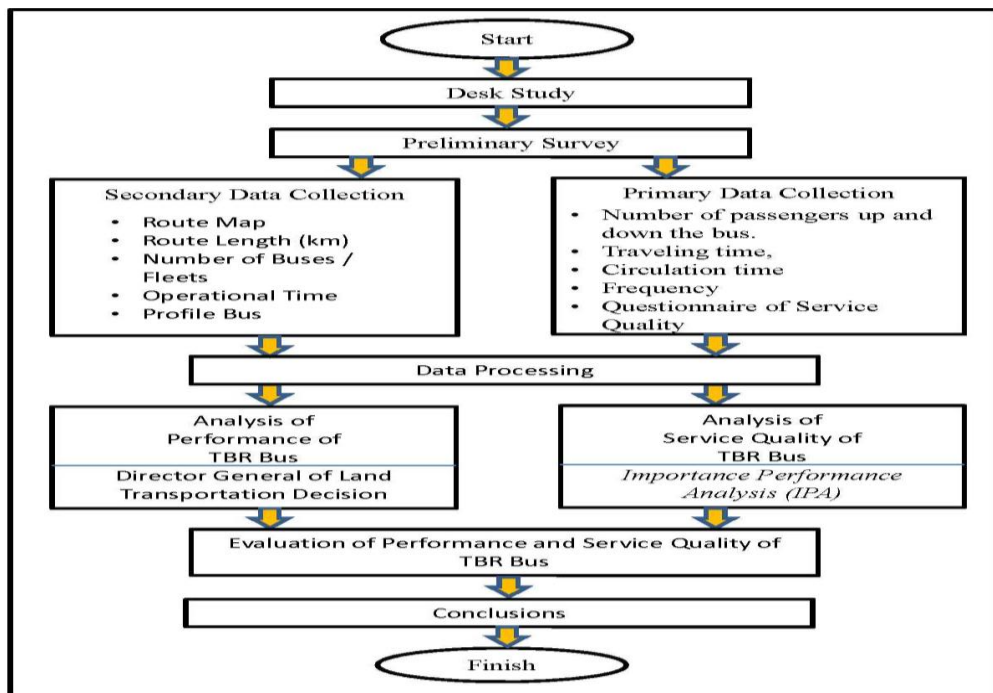


Fig. 2. Methodology of research

4.1 Data collection method

Data collection was done by two approaches, dynamic survey and static survey. Dynamic surveys are conducted on top of the vehicle to collect data, among others: the number of passengers up and down the vehicle, travel time including delays, stop time to take and down passengers, and vehicle speed. Static surveys are conducted outside the vehicle to record vehicles number in operation, travel time, circulation time and service frequency.

4.2 Variable selection of service quality

The service quality appraisal approach used is the ServQual method developed by Parasuraman, quoted from Muluk [6]. ServQual divides the service quality into five dimensions (main variable): Reliability, Responsiveness, Assurance, Empathy, and Tangibles (physical evidence).

The main variables of service quality are described in several sub variables, as follows:
1. Area and comfort of bus stops. 2. Cleanliness and neatness of bus stops. 3. Completeness of bus stop Facility. 4. Cleanliness and tidiness of officers. 5. Service time for customers. 6. Knowledge of officers of consumer needs. 7. Service is conducted professionally during the trip 8. Discipline and responsibility of officers. 9. Hospitality and courtesy of officers. 10. Service is done thoroughly. 11. The role of officer's responds to criticism and suggestions 12. Responsiveness of officer to handle consumer complaints. 13. Knowledge and ability of officers to handle problems. 14. Skills of officers to handle consumer needs. 15. Reliable and assurance security; 16. Officer's Attention to consumer. 17. The services provided do not view social status / gender. 18. The officer's care to the needs and the desire of consumers

4.3 Trans Bandung Raya Bus (TBRB)

Trans Bandung Raya Bus is a bus that is a mass transit mass transportation strived by the City Government of Bandung. The bus system is based on a service system that has characteristics such as: scheduled of bus departure, punctual, stop at bus stop, safe, convenient, reliable, affordable and friendly for the environment. TBRB has been operating in hopes of reducing the number of private vehicles and public transportation, as well as congestion solutions in Bandung and surrounding areas. TBRB is managed by Damri Public Company. The number of TBRBs available and has an operating license at the Elang Terminal - Jatinangor Terminal is 18 buses, but fully operational only 15 units.

The distance from Elang Terminal to Jatinangor Terminal is 26.7 Km. Location of research, routes and distances are described as follows:

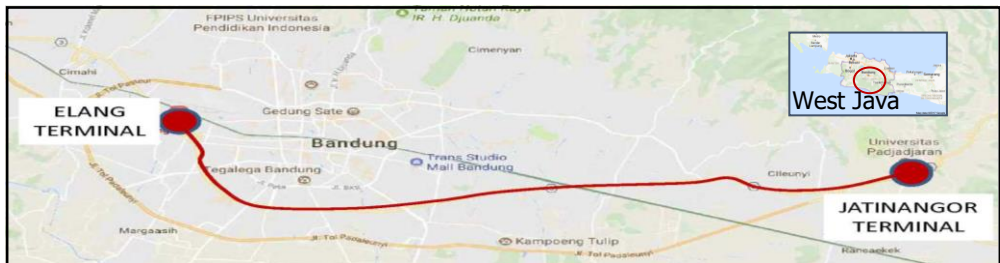


Fig. 3. Location of research

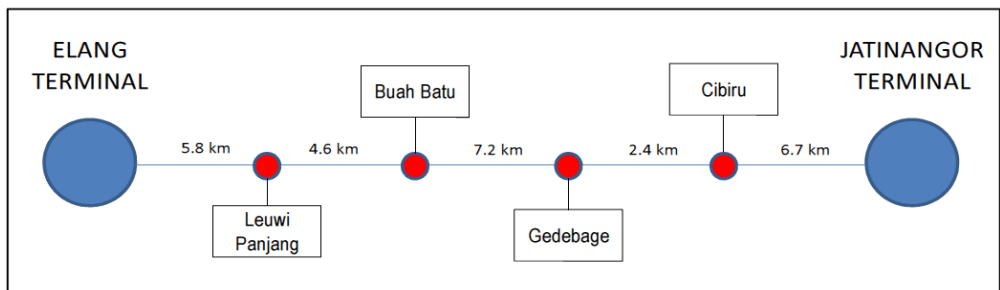


Fig. 4. Route and distances

TBR Bus Capacity based on interviews is 70 passengers, consisting of 30 seated passengers and 40 standing passengers. Passengers are allowed to stand because the distance and travel time is relatively short.

4.4 Performance analysis of TBR BUS

Based on the survey and analysis, the performance of Trans Bandung Raya Bus can be seen in the following table:

Table 3. TBR Bus performance for route of Elang Terminal – Jatinangor Terminal

NO	INDICATOR	UNIT	ASSESMENT STANDARD			RESULT	VALUE OF PERFORMANCE
			NOT GOOD (1)	MODERATE (2)	GOOD (3)		
1	Load factor, busy hour	%	> 100	80 – 100	< 80	55.72	3
2	Load factor, no busy hour	%	> 100	70 – 100	< 70	42.86	3
3	Travel speed	Km/hour	< 5	5 – 10	> 10	23.21	3
4	Headway	Minutes	> 15	10 – 15	< 10	10	2
5	Time travel	Minutes/	> 12	6 – 12	< 6	69.02	1
6	Service time	Hour	< 13	13 - 15	> 15	15	2
7	Frequency	Vehicle/h	< 4	4 - 6	> 6	6	2
8	Number of operating veh.	%	< 82	82 - 100	100	83	2
9	Waiting time	Minutes	> 30	20 - 30	< 20	5	3
10	Start and end time of the trip	Time	05.00-18.00	05.00-20.00	05.00->20.00	05.00-20.00	2
Total Value of Performance							

Based on the performance assessment in the above table, it can be said that based on the standards of the Ministry of Transportation, the performance of Trans Bandung Raya Bus is included in the "Good" category.

4.5 Number of TBR Bus needs

Circulation time of TBR Bus on busy time for route of Elang Terminal - Jatinangor Terminal is 184.24 minutes. Circulation time of TBR Bus on not busy time is 165 minutes. The maximum number of passengers based on survey results is 331 people per hour. TBR Bus Needs per Circulation Time (K) on route of Elang Terminal - Jatinangor Terminal is calculated based on time between vehicles, is 21 vehicles / circulation. While in the busy hour period (K') requirement is 14 vehicles.

4.6 Service quality analysis of TBR Bus

The service quality of TBR Bus by users is measured based on the level of satisfaction. Service quality is divided into 5 main variables and 18 sub variables. Based on the analysis of main variables already mentioned above, the average value of service perception (Performance) is 2.63 and the average value of service expectation (Importance) is 3.30. The satisfaction level of TBR Bus's users is 79.39%. Means, at this time, service quality of TRB Bus has not satisfied users. The analysis results are described in the IPA quadrant, the result is as follows:

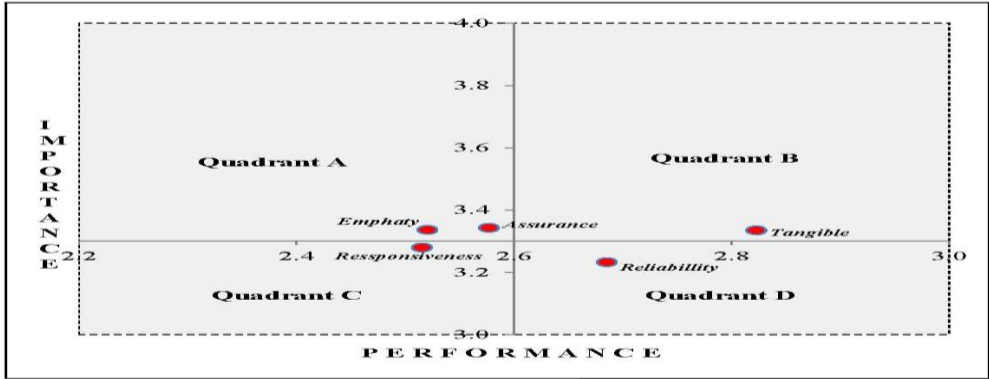


Fig. 5. IPA analysis of main variables of TBR Bus service quality

Based on the Cartesian diagram above, it can be explained: In the Cartesian diagram above, there are 2 main variables that are in quadrant A is Empathy and Assurance. This means that variables need to be improved / upgraded by the management of the TBR Bus. The implementation of TBR Bus service related to empathy and assurance still can't fulfill the expectation from TBR Bus users.

The responsive variable is in the quadrant C, which means that this variable needs to be increased steadily, although this is not a priority variable. The tangible variable is in the B quadrant, meaning the user judges this variable as a good category and needs to be maintained. While the variable reliability is in quadrant D, which means this variable is good, but felt more than is needed.

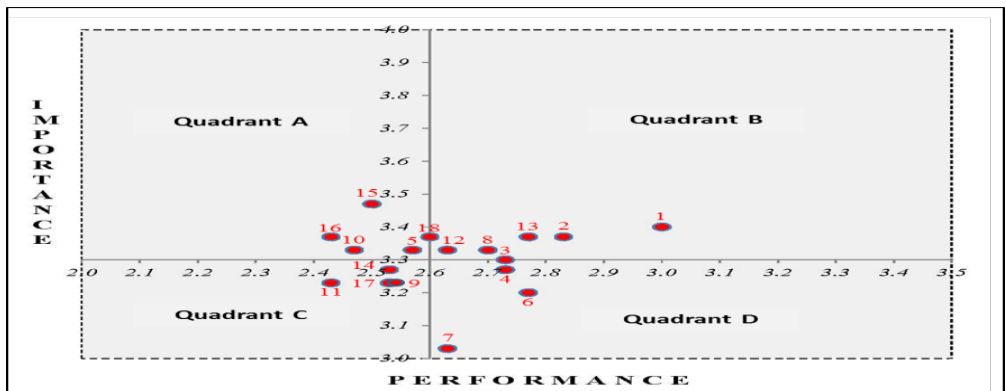


Fig. 6. IPA analysis of service quality sub variable of TBR Bus

Quadrant A (Concentrate here / Main Priority): In this quadrant, the user assesses, the service quality of TBRB is lower than the user's expectation, or it can be said that the service level of some aspects in quadrant A is still disappointing / unsatisfactory, so the management of TBRB should pay attention, and improve some aspects of it. Some aspects that need to be improved / improved quality are: service time for customers, service is done thoroughly, reliable and assurance security, officer's attention to consumer, and the officer's care to the needs and the desire of the consumers.

Quadrant B (Keep Up good Work): Shows some aspects that have been good or are appropriate between the implementation and expectations of users, so the factors need to be maintained and developed. These aspects are: area and comfort of bus stop, cleanliness and neatness of bus stops, completeness of bus stop facility, discipline and responsibility of

officers, responsiveness of officers to handle consumer complaints, and knowledge and ability of officers to handle problems.

Quadrant C (Low Priority): Indicates some aspect of performance value is lower than the user's desire, so it is said to be less satisfactory so it needs to be improved, but that aspect includes low priority scale. These factors include: hospitality and courtesy of officers, the role of officer's responds to criticism and suggestions, skills of officers to handle consumer needs and the services provided do not view social / gender status.

Quadrant D (Possible Overkill): Factors in quadrant D are considered satisfactory and redundant in their implementation, although the user considers these factors less important. These factors are: Cleanliness and tidiness of officers, knowledge of officers of consumer needs, and service are conducted professionally during the trip. However, TBR Bus management should keep these factors performing well to maintain service quality for users, considering these factors will affect overall service quality.

5 Conclusion

Based on analysis results of performance and service quality of Trans Bandung Raya Bus on route Elang Terminal - Jatinangor Terminal, can be concluded:

Load factor value at busy hours is 55,72%, while load factor value at not busy hours is 42,86%, velocity 23,21 km/hour, 10 minutes headway, travel time 2,97 minutes/km, daily service time is 15 hours, frequency 6 vehicles/hour, total operating vehicles 83%, 5 minutes waiting time, starting and ending travel time from 05.00 WIB to 20.00 WIB. Based on the result above, the overall value calculated at 23 which categorized as good performances.

Number of TBR Bus of Elang Terminal – Jatinangor Terminal route needed is 21 units / circulation time, with 8.88 minutes headway. Currently, operational permits are available for 18 buses, but there are only 15 buses fully operational. This finding can be used by the government as a consideration to evaluate and to add more bus vehicles service on route of Elang Terminal – Jatinangor Terminal.

Based on calculations using Importance Performance Analysis (IPA) as an instrument to assess the service quality, results explained below:

- a. The service quality performance of TBR Bus has not met the expectations of TBR Bus users. This can be seen from the value of service perception (performance) is lower than value of service expectation (importance): $2.63 < 3.30$.
- b. Empathy and assurance have the lowest value based on user surveys. This indicates that aspects should be improved well (priority) by TBR Bus management.
- c. The detail aspects that need to be improved are: speed of officers to serve customers, service is done thoroughly, reliable and assurance security, officer's attention to consumer, and the officer's care to the needs and the desire of the consumers.

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