International Journal of Scientific Engineering and Science
Volume 8, Issue 8, pp. 83-89, 2024. ISSN (Online): 2456-7361

Evaluation of Operational Performance and Transjakarta Services Corridor 3F Kalideres-Gelora Bung Karno (GBK)

Agnes Laura Sianturi[1], Muhammad Isradi[2*]
[1]Undergraduate Student of Department Civil Engineering, Universitas Mercu Buana, Jakarta, Indonesia-11650
[2]Department of Civil Engineering, Universitas Mercu Buana, Jakarta, Indonesia-11650
Email address: agneslaura19@gmail.com, isradi@mercubuana.ac.id

Abstract—*TransJakarta is one of the BRT transportation systems that provides a solution to accelerate the high mobilization rate in DKI Jakarta. One of the strategic corridors of TransJakarta travel is the 3F corridor. This study aims to analyze the service and operational performance of TransJakarta corridor 3F, user satisfaction and certain indicators that need to be improved. This research uses data based on field surveys and questionnaire instruments distributed to 100 respondents. The analysis methods used in this research are Importance Performance Analysis (IPA), Quality Function Development (QFD) and calculation of operational data based on SPM Perum PPD and DKI Jakarta Governor Regulation No. 13 of 2019. Based on the results of the analysis, bus operational performance is good with categories A and B in each indicator. Based on the IPA average suitability level with a score of 90%, there are 6 indicators on the unsatisfactory performance of TransJakarta Corridor 3F. As a recommendation, it is necessary to improve the indicators of bus headway, service information, information on arrival times and travel disruptions, SOPs for vehicle operation and emergency handling, handrail facilities for standing passengers, comparison of the number of passengers.*

Keywords—*TransJakarta, Importance performance analysis, Quality Function Development, Operational performance.*

I. INTRODUCTION

Congestion in urban areas is a problem that has high complexity which must be resolved one by one to be able to solve it (Liu et al. 2023). This can be influenced by several factors, one of which is urban population growth which continues to increase throughout the year due to increasing urbanization. Currently the population in DKI Jakarta has reached 11,436,004 people and has a population density of 17,153 people/km² (Isradi and Satrio 2021).

A large population is directly proportional to the need for large movement and mobility (Chikkabagewadi, Devappa, and Karjinni 2022).The need for high movement should be facilitated by the existence of adequate public transportation facilities. DKI Jakarta has various modes of public transportation to meet movement needs, one of which is the Transjakarta Bus (Firdaus et al. 2021, 2022). Transjakarta buses have officially operated as public transportation in DKI Jakarta since February 1,2004 and are public transportation that is quite popular with the people of Jakarta (Madani et al. 2024).

One of the busiest bus corridors in Transjakarta is corridor 3F on the Kalideres-Gelora Bung Karno (GBK) route, especially during work entry and work hours. Therefore, the need for public transportation to facilitate mobility in this area is quite high (Isradi and Pratama 2020). The main factor that determines people's choice of public transportation is the speed of service because road infrastructure that is not hampered by traffic jams means passengers can reach their destination on time (Dermawan, Bimantara, and Isradi 2021). Apart from that, comfort is also the most important reason for other public transportation passengers to prefer the transportation facilities provided by this country (Siddique and Basak 2018).

II. RESEARCH METHOD

A. Location and Time Research

The location of this research was along the TransJakarta Corridor 3F (Kalideres - Gelora Bung Karno) travel route. This research was conducted on one working day (between Monday - Friday). The implementation time of this research is in the morning (07.00 - 10.00 WIB) and in the afternoon (16.00 - 19.00 WIB).

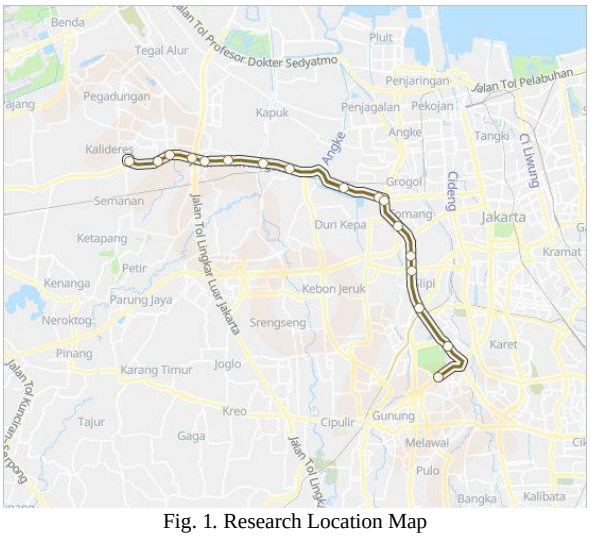

Fig. 1. Research Location Map

B. Data Collection

The data in this study were obtained from direct field surveys to determine the load factor, speed, headway, travel time, service time, bus frequency, number of vehicles operating, and waiting time (Dwiatmoko et al. 2022). In

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Volume 8, Issue 8, pp. 83-89, 2024. ISSN (Online): 2456-7361

addition, data collection techniques were also carried out by distributing questionnaires to 100 respondents who were TransJakarta Corridor 3F Jakarta passengers (Mutiawati, Suryani, and Anggraini 2022). This number of respondents has been adjusted to the calculation of the Slovin formula to calculate the number of samples as representative of a population (Girma et al. 2022).

All questions in the questionnaire are relevant to the performance and interests of passengers in the services provided (Isradi, Farhan, et al. 2021; Isradi, Stini, et al. 2021). The indicators in the questionnaire refer to the factors of security, safety, comfort, affordability, equality, and regularity which refer to the Minimum Service Standards of DKI Jakarta Governor Regulation No. 13 of 2019. The variables in this study are performance (variable X) and importance (variable Y) (Rachmadina et al. 2023).

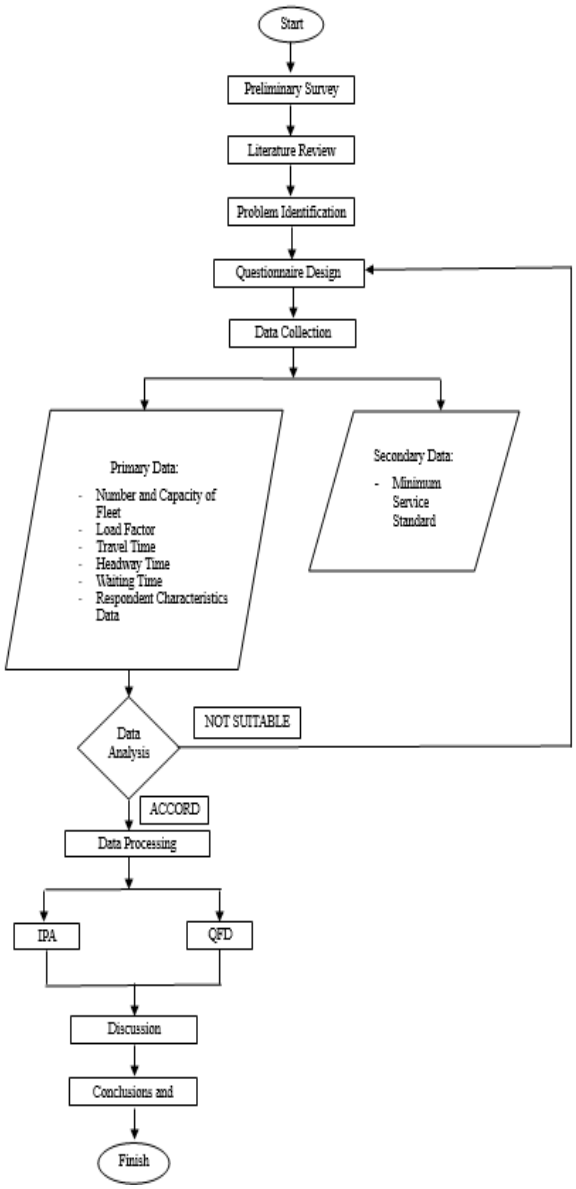

Fig. 2. Research Flow Chart

C. Data Processing and Analysis Data

Data processing in this study is to process data obtained from field survey results and questionnaire data. After that, the results of the field survey will be compared with the value of the minimum service standards (SPM) of Perum PPD and for the results of the questionnaire will be tested for validity and reliability with a sample size of 30 samples (Sugiyono 2020). These two tests are carried out to measure the validity and reliability of the data (Janna and Herianto 2021). This test was carried out using SPSS software. Then, after being declared valid and reliable, the data will be processed using the Importance Performance Analysis (IPA) and Quality Function Development (QFD) methods. Several formulas will be used in this study (Sugiarto et al. 2021).

1. *Formulas Based on Field Survey*

$$L_f = \frac{JP}{C} \times 100\% \quad \text{.....(1)}$$

Description :
L_f = Load factor (%)
JP = Number of Passengers (people)
C = Vehicle Capacity (people)

$$C = c + c' \quad \text{.....(2)}$$

Description :
C = Vehicle capacity (people)
c = Number of seats (pieces)
c' = Number of *handgrips* (pieces)

$$H = T2 - T1 \quad \text{.....(3)}$$

Description:
H = *Headway* (minutes)
$T1$ = Arrival time of the first bus
$T1$ = Second bus arrival time

$$\text{Speed} = \frac{Distance\ between\ bus\ stop}{Travel\ time} \quad \text{.....(4)}$$

$$Q = \frac{n}{T} \quad \text{.....(5)}$$

Description :
Q = Frequency (vehicles per hour)
N = Number of vehicles passing through the observation point
T = Observation time interval (hour)

$$T = \frac{t}{s} \quad \text{.....(6)}$$

Description :
T = Travel time (minutes/hour)
t = Total travel time (minutes)
s = Total distance traveled (km)

$$\text{Passenger Waiting Time} = \frac{1}{2} \times H \quad \text{.....(7)}$$

Description:
H = *Headway (minutes)*

2. *Importance Performance Analysis (IPA) Formulas*

$$TK_i = \frac{X_i}{Y_i} \quad \text{.....(8)}$$

Description:
TK_i = Respondent's level of conformity
X_i = Average score of performance assessment
Y_i = Average score of expectation assessment

$$\bar{X} = \frac{\Sigma X_i}{n} \quad \text{dan} \quad \bar{Y} = \frac{\Sigma Y_i}{n} \quad \text{.....(9)}$$

Description:
$\bar{X}$ = Weighted average assessment of service performance of 3F corridor operational vehicles across indicators

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$\bar{Y}$ = Weighted average assessment of the level of interesr of respondentst of passengers across indicators
n = Number of respondent

$$\bar{\bar{X}} = \frac{\sum_i^n X_1}{k} \text{ dan } \bar{\bar{Y}} = \frac{\sum_i^n Y_1}{k} \quad \text{.....(10)}$$

Description:
$\bar{\bar{X}}$ = Average of average performance scores
$\bar{\bar{Y}}$ = Weighted average passenger importance assessment of all indicators
k = Number of attributes/factors that affect performance assessment

3. Quality Function Development (QFD) Formulas

$$\text{IoC} = \frac{Goal}{\Sigma Goal} \text{.....(11)}$$

$$IR = \frac{Goal}{\text{CSP}} \text{.....(12)}$$

$$RW = Goal \text{ x IR x } Sales\ Point \text{ .....(13)}$$

$$NRW = \frac{Raw\ Weight}{\Sigma Raw\ Weight} \text{ .....(14)}$$

III. Result and Discussion

A. Calculation of Operational Performance

Based on the results of the field survey on operational performance (load factor, speed, headway, travel time, service time, bus frequency, number of vehicles operating, and waiting time) TransJakarta Corridor 3F which will be categorized according to the scores obtained through several calculation and analysis processes and then compared to the scores set in the Minimum Service Standards of Perum PPD. The results of the calculation and analysis based on the results of the field survey can be seen in the table 1.

TABLE I. Operational Performance of TransJakarta Bus Corridor 3F

No	Indicator	Operational Performance on Weekdays			
		Morning	Category	Afternoon	Category
1	Load factor at peak hour	0,765	A	0,765	A
2	Speed of travel (km/h)	27 km/h	A	23 km/h	A
3	Headway (minute)	6 minute	A	7 minute	A
4	Time of service	17 hour	A	17 hour	A
5	Frequency	10 bus	A	8 bus	A
6	Travel Time	48 minute	A	76 minute	B
7	Passenger waiting time	3 minute	A	3,5 minute	A

TABLE II. Respondent Characteristic

No	Characteristic		Number of Respondents	Percentage
1	Gender	Male	38	38%
		Female	62	62%
2	Age	≤ 20 years	15	15%
		21 - 30 years	60	60%
		31 - 40 years	23	23%
		41 - 50 years	1	1%
		51 - 60 years	1	1%
		> 60 years	0	0%
3	Education Level	Junior High School	10	10%
		High School	21	21%
		D3 / S1	62	62%
		S2	6	6%
		S3	1	1%
4	Type of Employment	Student	30	30%
		Private Employee	32	32%
		SOE Employee	10	10%
		PNS/TNI/Polri	2	2%
		Self-employed	20	20%
		Others	6	6%
5	Frequency of Use	≤ 5 times	57	57%
		6 - 8 times	33	33%
		8 - 10 times	4	4%
		10 - 12 times	2	2%
		> 12 times	4	4%
6	Purpose	School/College	26	26%
		Work	51	51%
		Recreation	8	8%
		Sports	13	13%
		Other	2	2%
7	Domicile	Jakarta	65	65%
		Bekasi	12	12%
		Depok	5	5%
		Bogor	3	3%
		Tangerang	14	14%
		Other	1	1%

B. Validity and Reliability Test

The validity test and reliability test are testing instruments to measure the validity and reliability of data. The requirements for the validity test are the value of r count> r table and the significance value <0.05. As for the reliability test, the test requirement is the Cronbach's alpha value> significant level, then the data is considered reliable. In this test, the Cronbach's alpha value is taken as 0.7 to state that the data is acceptable (Slamet and Wahyuningsih 2022). Validity and reliability tests were carried out on 30 samples of each variable X (performance) and variable Y (importance) using SPSS software. The following are indicators of questions on performance and importance assessments, the results of validation tests and reliability tests are attached in table 3, table 4 and table 5.

TABLE III. TransJakarta Corridor 3F Assessment Question Indicator

Assessment Question Indicator		
Regularity	P1	Arrival time between buses (headway) at hour busy every 5 minutes.
	P2	Bus stopping time at each stop for 1 minute.
	P3	Stable bus travel speed (average speed 50km/h).
Assessment Question Indicator		
Regularity	P4	Service information related to bus stop name, location map,lane guidance, and in-bus audio alerts.
	P5	Information on coming to visit travel.
	P6	Convenient ticket payment system and methods.
Security	P7	Driving identity and identification at driver.
	P8	There is an attendant on duty in the bus.
	P9	The darkness of the window film and CCTV in the bus.
Safety	P10	SOP for vehicle operation and handling emergencies.
	P11	Test the fitness of the bus before it is operated.
	P12	In-bus safety equipment facilities such as fire extinguisher, automatic door opener button and glass breaker hammer.
	P13	Health facilities such as first aid kits in the bus.
	P14	Bus complaint number information.
	P15	Handrail facilities for standing passengers on the bus.
	P16	Automatic entrance and exit function in the bus.
Comfort	P17	Lighting and supporting facilities air circulation.
	P18	There are cleaners at each stop.
	P19	Easy facility to get on and off the bus (difference height between the bus and the bus stop floor).
	P20	Comparison of the number of passengers on the bus with bus carrying capacity (bus density).
	P21	Standing room comfort when waiting for the bus at stop.
Affordability	P22	Availability of bus integration with public transportation and ease of access to the bus stop.
Equality	P23	Availability of priority seats on the bus.
	P24	Availability of dedicated space for wheelchairs in bus.

TABLE IV. Performance Validation Test Results (X) and (Y)

Variables	R Table	Significance	Performance Validation Test Results (X)		Performance Validation Test Results (Y)		Description
			R Count SPSS	Significance SPSS	R Count SPSS	Significance SPSS	
P1	0,361	0,05	0.702	0.000	0.750	0.000	Valid
P2			0.658	0.000	0.738	0.000	Valid
P3			0.784	0.000	0.707	0.000	Valid
P4			0.755	0.000	0.814	0.000	Valid
P5			0.757	0.000	0.725	0.000	Valid
P6			0.834	0.000	0.878	0.000	Valid
P7			0.760	0.000	0.619	0.000	Valid
P8			0.879	0.000	0.723	0.000	Valid
P9			0.828	0.000	0.614	0.000	Valid
P10			0.846	0.000	0.853	0.000	Valid
P11			0.780	0.000	0.866	0.000	Valid
P12			0.775	0.000	0.882	0.000	Valid
P13			0.731	0.000	0.708	0.000	Valid
P14			0.771	0.000	0.775	0.000	Valid
P15			0.810	0.000	0.874	0.000	Valid
P16			0.769	0.000	0.856	0.000	Valid
P17			0.804	0.000	0.905	0.000	Valid
P18			0.671	0.000	0.8	0.000	Valid
P19			0.810	0.000	0.802	0.000	Valid
P20			0.703	0.000	0.722	0.000	Valid
P21			0.801	0.000	0.703	0.000	Valid
P22			0.763	0.000	0.823	0.000	Valid
P23			0.809	0.000	0.843	0.000	Valid
P24			0.708	0.000	0.824	0.000	Valid

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Volume 8, Issue 8, pp. 83-89, 2024. ISSN (Online): 2456-7361

TABLE V. Reliability Test Results Performance (X) and Interests (Y)

Variables	Terms *Cronbach's alpha*	*Cronbach's* SPSS *alpha*	Number of Indicators Question	Description
X	0.7	0.966	24 items	*Reliable*
Y	0.7	0.968	24 items	*Reliable*

C. *Importance -Performance Analysis*

The Importance Performance Analysis (IPA) method is a descriptive analysis method to identify indicators that need to be prioritized and require improvement. This method is divided into 4 quadrants, where each quadrant is used as a consideration to assess indicators of consumer interest. In this method, if the GAP between variable X (performance) and variable Y (importance) is negative, it can be concluded that performance is still lower than user expectations and perceptions. Then to measure the level of conformity between the performance weight and the interests of passengers, the level of conformity must be calculated. If the level of conformity is 100% then the passenger is considered satisfied, but if the level of conformity is <100% then the passenger is considered less satisfied with several indicators listed in Table 4. The following are the results of the calculation of the level of conformity listed in Table 7 and the Importance position map.

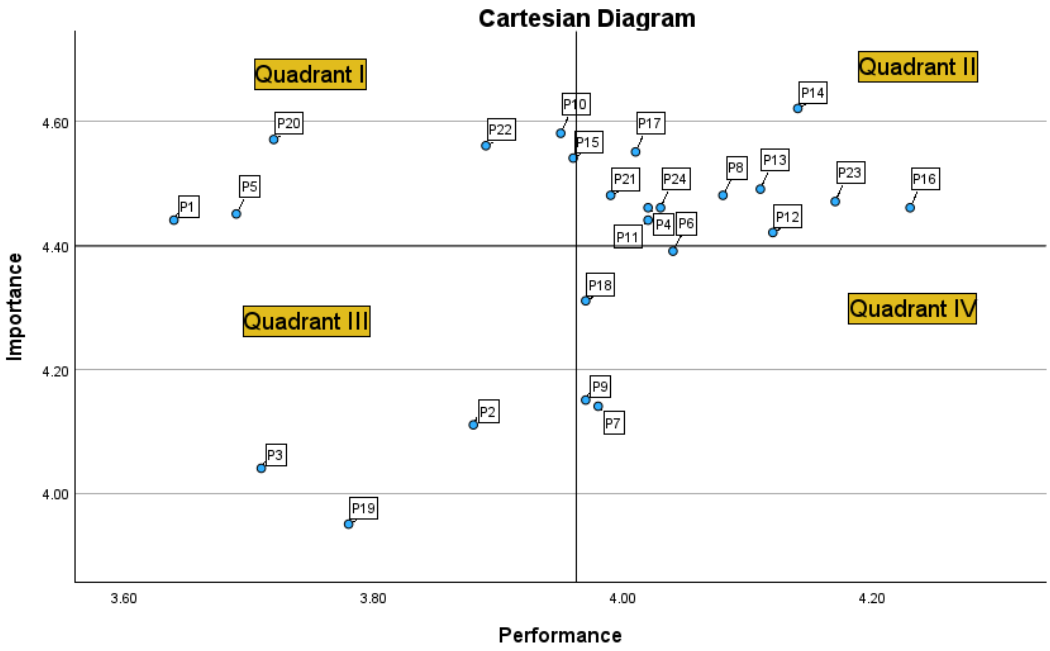

Fig. 3. Cartesian Diagram

The results obtained based on the data in the IPA cartesian diagram above are as follows:

1. Quadrant I

This quadrant describes that each indicator is considered important or has a top priority scale but has low performance. This implies that *stakeholders* must have a high focus on improving services on this indicator so as not to cause disappointment from users. Indicators included in quadrant I, namely:

a. P1, Bus arrival time (headway) during peak hour every 5 minutes.
b. P5, Information on arrival and travel disruptions.
c. P10, SOP for vehicle operation and emergency handling.
d. P15, Handrail facilities for standing passengers on the bus.
e. P20, Comparison of the number of passengers on the bus with the carrying capacity of the bus (bus density).
f. P22, Availability of bus integration with other public transportation and ease of access to bus stops Availability of dedicated space for wheelchairs in buses.

2. Quadrant II

a. P4, Service information related to bus stop names, location maps, lane markers, and audio warnings on the bus.
b. P6, Convenient ticket payment system and method
c. P8, There is an attendant on duty in the bus.
d. P11, Test the bus for airworthiness before operation.
e. P12, Safety equipment facilities in buses such as fire extinguishers, automatic door opening buttons and glass breaking hammers.
f. P13, Health facilities such as first aid kits in the bus.
g. P14, Bus complaint number information.
h. P16, Automatic entrance and exit function in the bus.
i. P17, There are lighting and air circulation support facilities.

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j. P21, Comfortable standing space while waiting for the bus at bus stops
k. P23, Availability of priority seats on the bus.
l. P24, Dedicated space for wheelchairs in the bus.

3. Quadrant III
i. P2, Bus stopping time at each stop for 1 minute
ii. P3, Stable bus travel speed (average speed 50km/h).
a. P19, Easy facility to get on and off the bus (height difference between bus and bus stop floor).

4. Quadrant IV.
i. P7, Identity of the vehicle and identification on the driver.
a. P9, Darkness of window film and CCTV in the bus.
b. P18, There are cleaners at each bus stop.

D. QFD Analysis

Quality Function Development (QFD) analysis technique is an analysis technique that converts technical customer needs into a product or service to realize the relationship of customer needs in a systematic and quality manner (Yunike 2016). The first step in the QFD analysis is to find out the Voice of Customer (VOC) or the perception of the customer. Then proceed with the creation of the House of Quality (HOQ).

TABLE VI. QFD Analysis Calculation

Voice of Customer	Goal	IoC	CSP	IR	Sales Point	RW	NRW
Bus arrival time (headway) at peak hour every 5 minutes	4,60	0,1711	3,64	1,26	1,5	8,694	0,194
Arrival time and travel disruption information.	4,03	0,15	3,69	1,09	1,5	6,589	0,147
SOPs for vehicle operation and emergency handling.	4,58	0,1704	3,95	1,16	1,4	7,438	0,166
Handrail facilities for standing passengers on the bus.	4,54	0,1689	3,96	1,15	1,3	6,787	0,151
The ratio of the number of passengers on the bus to the carrying capacity of the bus (bus density).	4,57	0,17	3,72	1,23	1,3	7,307	0,163
Availability of bus integration with other public transportation and ease of access to bus stops ease of access to bus stops	4,56	0,1696	3,89	1,17	1,5	8,003	0,179

TABLE VII. QFD Analysis Calculation

RT	Relationship Value	NRW	Contribution	NC	AI	Priority
RT-1	3	0,194	0,582	0,1171	13,8	3
RT-2	5	0,147	0,735	0,1479	22,25	1
RT-3	5	0,147	0,735	0,1479	22,25	2
RT-4	3	0,166	0,498	0,1002	13,74	4
RT-5	3	0,163	0,489	0,0984	13,71	5
RT-6	3	0,163	0,489	0,0984	13,71	6
RT-7	3	0,179	0,537	0,1080	13,68	7
RT-8	3	0,151	0,453	0,0911	13,62	8
RT-9	3	0,151	0,453	0,0911	13,62	9

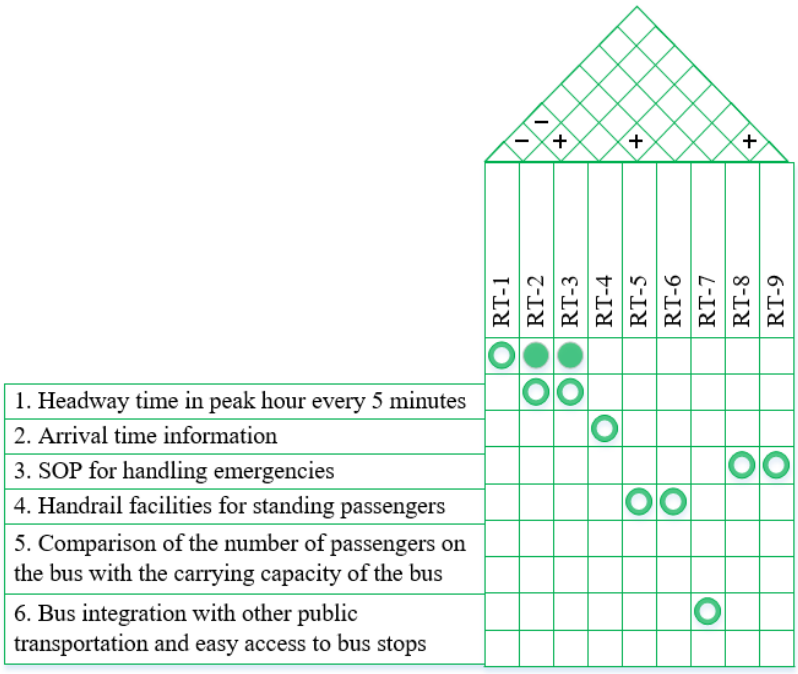

Fig. 4. House of Quality

IV. CONCLUSION

Based on the results of the research discussion on the Evaluation of Operational Performance and Service Performance of Transjakarta Corridor 3F route Kaliders-GBK, it can be concluded that .

1. Operational Performance of Transjakarta Corridor 3F route Kaliders-GBK

a. Load Factor

The average *load factor* in the morning on weekdays is 75.8%, for the average *load factor* in the afternoon on weekdays is 75.8% on weekdays. For these results it is considered "excessive" or the occurrence of *over* passengers with the standard *load factor* set at 70%. So that the LF value is fulfilled but *over the* capacity of the single bus.

b. Headway

Headway is the interval time between one city transportation fleet passing at one point with another fleet passing at the same point on a public transportation route or route in the same direction. Overall the Transjakarta *headway* Corridor 3F Kaliders-GBK route has not met the standards of the Land Transportation Agency guidelines in accordance with the standard value of peak *headway* with numbers 2-5 minutes with an average headway value of 6.5 minutes.

c. Travel Time

Travel time for Transjakarta Corridor 3F Kaliders-GBK route for the outbound route is 48 minutes and for the return 76 minutes with an average speed of 3.2 km/minute on weekdays.

Based on User Perceptions There are five aspects or indicators of the performance of Transjakarta Corridor 3F services on the Kaliders-GBK route that are deemed necessary to be improved with the results of a satisfactory level of satisfaction. The six indicators are bus *headway* indicators, service information, arrival time information and travel disruptions, vehicle operation SOPs and emergency handling, handrail facilities for standing passengers, comparison of the number of passengers on the bus with the bus carrying capacity and the availability of bus integration with other public transportation and easy access to reach bus stops. With these six aspects, it is necessary to prioritize handling to improve service performance.

Based on the results of QFD analysis, the three highest obtained are the addition of arrival information units, the second position is to improve the signal / device that detects the arrival of buses to be more accurate and the third position is the addition of Transjakarta corridor 3F units. Of the three attributes are prioritized in improving operational performance and service performance of Transjakarta Corridor 3F Kaliders-GBK route based on the highest *Absolute Importance*.

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