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Optimization of Facilities and Infrastructure as a Strategy for the Development of MRT Jakarta Services

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ABSTRACT
Abstract: *Improving the quality of MRT Jakarta services requires an evaluation of user satisfaction to support effective service development strategies. This study aims to analyze user satisfaction and formulate priority strategies for improving MRT Jakarta's infrastructure and rolling stock through the integration of the Customer Satisfaction Index (CSI) and Importance Performance Analysis (IPA) methods. A quantitative approach was employed using primary data collected from 400 MRT Jakarta users, supported by secondary data from PT MRT Jakarta, the Minimum Service Standards (SPM), and relevant literature. The results show that the CSI values for station infrastructure and rolling stock are 83.16% and 83.77%, respectively, both classified as Very Good. However, the IPA results identified several priority attributes requiring improvement, including operational reliability, feeder transport and travel information, passenger safety facilities, and train identification numbering. The integration of CSI and IPA produced development strategies focused on improving priority service attributes while maintaining well-performing services. This integrated approach provides a more comprehensive basis for determining priorities to support the sustainable improvement of MRT Jakarta services.*

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1. INTRODUCTION

MRT Jakarta is one of the main modes of mass transportation in DKI Jakarta that plays a role in increasing public mobility efficiently, safely, and sustainably and encouraging the transition from private vehicles to public transportation. The success of service delivery is highly determined by the quality of service, which depends on the ability of operators to understand and meet the needs and expectations of users [1]. The quality of public transportation services is influenced by the performance of supporting facilities and infrastructure. Facilities include comfort, security, and passenger information systems, while infrastructure includes stations and their supporting facilities. The availability and quality of these two aspects have a direct effect on the user experience in using public transportation services [2].

The quality of MRT Jakarta service refers to the Jakarta Governor's Regulation Number 95 of 2019 concerning Minimum Service Standards (SPM) [3], which includes aspects of safety, security, reliability, comfort, convenience, and equality. The fulfillment of these standards is a performance indicator that must be met by operators. Research shows that good service quality and facilities have a positive effect on the satisfaction of MRT Jakarta users [4].

Service quality evaluation based on user perception is an approach that is widely applied in public transportation management. *The Customer Satisfaction Index* (CSI) is used to measure the level of user satisfaction, while *Importance*

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Performance Analysis (IPA) identifies service attributes that are priority for improvement based on the level of importance and performance [5]. However, most studies still apply the two methods separately so that the results are limited to satisfaction evaluation or determination of improvement priorities, without producing integrated strategic recommendations as the basis for the development of facilities and infrastructure [6].

Based on these conditions, an approach is needed that not only measures the level of user satisfaction, but also produces more implementable facility development directions. The development of transportation facilities and infrastructure needs to consider user needs, facility performance, and service improvement priorities so that resources can be utilized optimally [7]. Therefore, this study integrates *the Customer Satisfaction Index* (CSI) and *Importance Performance Analysis* (IPA) methods to analyze user satisfaction levels, identify priority attributes for improvement, and develop priority strategies for the development of MRT Jakarta facilities and infrastructure. The novelty of this research lies in the integration of CSI and IPA methods as the basis for the preparation of a more measurable and implementable facility and infrastructure development strategy to support the improvement of the quality of public transportation services.

2. RESEARCH METHODS

Research Location

The research was carried out on the Jakarta MRT Phase 1 corridor which connects Lebak Bulus Station to HI Roundabout Station with a track length of about 15.7 km. The research location includes 13 Jakarta MRT stations, the distribution of which is presented in **Figure 1.**

Figure 1. Distribution of Jakarta MRT Station Phase 1 Location

Research Approach

This study uses a quantitative approach with a survey method to analyze the level of user satisfaction with MRT Jakarta facilities and infrastructure. Data was collected through a questionnaire based on the attributes of the MRT Jakarta Minimum Service Standard (SPM), then analyzed using the *Customer Satisfaction Index* (CSI) method to measure user satisfaction level and *Importance Performance Analysis* (IPA) to identify service development priorities.

Data Sources and Types

This study uses primary data and secondary data. Primary data was obtained through the distribution of questionnaires to 400 MRT Jakarta users which were compiled based on the attributes of the Minimum Service Standards using a five-level Likert scale to measure the level of importance and performance level as the basis for the analysis *of the Customer Satisfaction Index* (CSI) and *Importance Performance Analysis* (IPA). Secondary data were obtained from the PT MRT Jakarta document, DKI Jakarta Governor's Regulation Number 95 of 2019 concerning Minimum Service Standards (SPM), as well as relevant scientific literature as a reference for the preparation of instruments and supporting research analysis.

Population and Sample

The research population is all users of MRT Jakarta Phase 1. Based on data from PT MRT Jakarta, the number of users throughout 2024 will reach 40,821,425 passengers or an average of 111,534 passengers per day, which is used as the basis for determining the size of the research sample [8]. The number of samples is determined using the Cochran formula with Finite Population Correction (FPC) so that a representative sample is obtained for the research population [9]. The sample determination formula is presented in Equation (1).

$$n_0 = \frac{Z^2 pq}{e^2} \quad (1)$$

$$n = \frac{n_0}{1+\frac{n_0-1}{N}} \quad (2)$$

With a confidence level of 95% (Z=1.96), population proportion (p=0.5), q=0.5, and error rate (e=0.05), the initial sample count was calculated using Equation (1) as follows:

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$$n_0 = \frac{(1{,}96)^2(0{,}5)(0{,}5)}{(0{,}5)^2}$$
$$n_0 = 384{,}16$$

Furthermore, a limited population correction is made using Equation (2) with the number of population (N) of 40,821,425 customers as follows:

$$n = \frac{384{,}16}{1+\frac{384{,}16-1}{40.821.425}}$$
$$n_0 = 384{,}15$$

Based on calculations using the Cochran formula with a confidence level of 95% and a *margin of error* of 5%, a minimum sample number of 384 respondents was obtained. In this study, the number of samples was set to 400 respondents to increase the representativeness of the data.

Research Variables and Attributes

The research variable is the satisfaction of MRT Jakarta users which is measured based on the perception of the level of *importance* and service *performance*. The research attributes were compiled referring to the Minimum Service Standards (SPM) in accordance with the Jakarta Governor's Regulation Number 95 of 2019, which includes six dimensions of service, namely safety, security, reliability, comfort, convenience, and equality. These attributes are the basis for measuring the level of satisfaction using *the Customer Satisfaction Index* (CSI) and determining development priorities through *Importance Performance Analysis* (IPA). The variable operationalization of MRT Jakarta infrastructure and MRT Jakarta facilities is presented in **Table 1** and **Table 2, respectively.**

Table 1. MRT Infrastructure Research Variables and Attributes

Aspects	Code	Statement
Safety	STA-SLM1	Safety, health and passenger boarding and disembarkation facilities on the platform are adequately available.
	STA-SLM2	Safety and health information at the station is clear and easy to understand.
	STA-SLM3	The station lighting is adequate to support the safety of the user.
	STA-SLM4	The station canopy provides adequate protection from the weather.
Security	STA-AMN1	CCTV at the station works well to guarantee the safety of users.
	STA-AMN2	Security guards are always available in the station area.
	STA-AMN3	*The Screen Door* (PSD) platform improves user safety at the station.
	STA-AMN4	Information on security disturbances is conveyed clearly and in a timely manner.
Reliability	STA-AND1	Station services (emergency evacuation, doors, elevators, escalators, and PSDs) function reliably.
	STA-AND2	The ticket sales service runs smoothly and effectively.
	STA-AND3	The ticket/card payment gateway works well.
	STA-AND4	The power backup system and emergency communication function reliably.
	STA-AND5	Information on train operating schedules is easily accessible and clear.
	STA-AND6	Train arrival information is updated in a timely manner.
	STA-AND7	The announcement through the loudspeakers was clearly heard throughout the station.
Convenience	STA-NYM1	Air circulation facilities (air conditioning/fans) are functioning properly
	STA-NYM2	The boarding and disembarkation facilities on the platform are adequate.

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Aspects	Code	Statement
	STA-NYM3	The prayer room at the station is conveniently used for worship.
	STA-NYM4	The waiting room (platform) is comfortable and able to accommodate passengers.
	STA-NYM5	The toilet and lactation room are clean and comfortable to use.
	STA-NYM6	Trash cans are available and station cleanliness is maintained.
	STA-NYM7	Access to enter, exit, and get on and off to the station is easy to reach.
Facilities	STA-MDH1	Access to services at the station is easy to reach and use.
	STA-MDH2	Forwarding transportation information is easily accessible and clear.
	STA-MDH3	Passenger service facilities are adequately available.
	STA-MDH4	Information on train travel disruptions is conveyed clearly and on time.
Equivalence	STA-STR1	Facilities for passengers with special needs are adequately and equally.

Table 2. Variables and Attributes of MRT Facilities Research

Aspects	Code	Statement
Safety	KRT-SLM1	MRT trains provide adequate health facilities.
	KRT-SLM2	Safety education information on trains provides a sense of security.
	KRT-SLM3	Safety facilities on the train are adequately available.
Security	KRT-AMN1	CCTV and information on security disturbances on the train are working well.
	KRT-AMN2	The security guards on the train are reliable.
	KRT-AMN3	The lighting inside the train provides a sense of security during the journey.
Reliability	KRT-AND1	MRT trains operate on time as scheduled.
	KRT-AND2	The emergency communication device on the train is working properly.
	KRT-AND3	The MRT train's electrical backup system is functioning well.
	KRT-AND4	The availability of train service information is clearly conveyed.
Convenience	KRT-NYM1	The space in the train is spacious and comfortable.
	KRT-NYM2	The air conditioning on the train is working well and convenient.
	KRT-NYM3	Hand handrails for standing passengers are sturdily available.
	KRT-NYM4	Luggage racks in the train are adequately available.
	KRT-NYM5	The cleanliness of the car is well maintained.
Facilities	KRT-MDH1	Easy-to-understand passenger service information system available
	KRT-MDH2	The MRT route map is clear and easily accessible.
	KRT-MDH3	The train sequence number is easy to find and recognize.
Equivalence	KRT-STR1	Facilities for passengers with disabilities are adequately available and easily accessible.

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Data Collection Techniques

Primary data was obtained through the distribution of questionnaires online using *Google Form* and offline to 400 MRT Jakarta users. The questionnaire contained the characteristics of the respondents as well as an assessment of the importance and performance level *of* service attributes based on the Minimum Service Standards (SPM) of MRT Jakarta. Secondary data was obtained through a documentation study from PT MRT Jakarta, Jakarta Governor's Regulation Number 95 of 2019 concerning Minimum Service Standards (SPM), as well as relevant scientific literature as supporting research.

Measurement Scale

The measurement of respondents' perception used a five-level Likert scale [10] to assess the importance and performance level of each MRT Jakarta service attribute. The higher the score given, the more positive the respondent's perception of the assessed attributes [11]. The measurement scale criteria are presented in **Table 3.**

Table 3. Importance Level and Performance Level Measurement Scale

Score	Importance Level	Performance Level
5	Very important	Excellent
4	Important	Good
3	Quite Important	Pretty Good
2	Not Important	Not Good
1	Very Unimportant	Very Bad

The respondents' answer scores were then weighted to obtain a percentage of the assessment on each service attribute using Equation (3).

$P = \frac{f}{n}$ x 100% (3)

Description:
P : Percentage of assessment results (%)
f : the frequency of answers in each assessment category
n : total number of respondents' answers
100% : konstanta

Test Research Instruments

Validity Test

The validity test was performed using *Pearson's Product Moment correlation* to test the relationship between the score of each statement item and the total score. The value of the correlation coefficient was calculated using Equation (4), and the instrument was declared valid if the calculated value of r_{was} greater than the $r_{value\ of\ the\ table}$ at a significance level of 5% [12].

$$r_{xy} = \frac{n\sum XY-(\sum X)(\sum Y)}{\sqrt{[n\sum X^2-(\sum X)^2][n\sum Y^2-(\sum Y)^2]}} \quad (4)$$

where,
rxy : Correlation coefficient
$\sum Y$: Total score
n : Number of respondents
$\sum X2$: The sum of the squares of the item score
$\sum Y2$: The sum of the squares of the total score
$\sum X$: Total item score
$\sum XY$: Total item score multiplication

Reliability Test

The reliability test was carried out using *the Cronbach's Alpha coefficient* to measure the internal consistency of the research instrument [13]. The instrument is declared reliable if it has *a Cronbach's Alpha* value ≥ 0.70 [14]. The *Cronbach's Alpha* formula used is presented in Equation (5).

$$r_{11} = \left[\frac{k}{k-1}\right]\left[1-\frac{\sum\sigma_b^2}{\sigma_t^2}\right] \quad (5)$$

where,
R11 : Reliability value (*Cronbach's Alpha*).
∑σb2 : Number of variants of the item.
k : The number of statements is large.
st2 : Varian total.

Metode *Customer Satisfaction Index* (CSI)

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The Customer Satisfaction Index (CSI) method is used to measure the level of satisfaction of MRT Jakarta users based on the comparison between the importance level and the level of performance in each service attribute. The CSI value describes the level of user satisfaction quantitatively so that it can be used as a basis for evaluating service quality [15].

The calculation of CSI is carried out based on the attributes of the Minimum Service Standards (SPM) of MRT Jakarta which includes aspects of safety, security, reliability, comfort, convenience, and equality. The calculation stages include Mean Importance Score (MIS), Mean Satisfaction Score (MSS), Weight Factor (WF), Weight Score (WS), and Customer Satisfaction Index (CSI). The interpretation of the CSI value used in this study is presented in Table 4.

Table 4. Interpretation of *Customer Satisfaction Index* (CSI) Value

CSI value (%)	Category
81,00–100,00	Excellent
66,00–80,99	Good
51,00–65,99	Pretty Good
35,00–50,99	Not Good
0,00–34,99	Very Bad

The stages of calculating *the Customer Satisfaction Index* (CSI) are carried out using the following equation.

a. Menentukan *Mean Importance Score* (MIS)

MIS is the average value of the level of importance for each attribute measured from all respondents shown in Equation (6).

$$MIS = \frac{\sum Y_i}{n} \quad (6)$$

where,

$\sum Y_i$: The value of the level of interest of the first respondent,

n : Total number of respondents.

b. Menentukan *Mean Satisfaction Score* (MSS)

MSS is the average value of the actual level of performance or customer satisfaction for each attribute shown in Equation (7).

$$MSS = \frac{\sum X_i}{n} \quad (7)$$

where,

$\sum X_i$: Value of the satisfaction level of the first respondent,

n : Total number of respondents.

c. Calculating *Weight Factor* (WF)

Weight Factor is the weight of the factor obtained from the percentage of the average value of the level of importance (MIS) of an attribute compared to the total average value of all attributes shown in Equation (8).

$$WF = \frac{MIS_i}{\sum MIS} \quad (8)$$

where,

MIS_i : the average level of importance of each attribute,

$\sum MIS$: The sum of the total MIS values of all attributes.

d. Calculating *Weight Score* (WS)

Weight Score is a weighted score obtained from the result of the multiplication between the weight factor (WF) and the average satisfaction level (MSS) shown in Equation (9).

$$WS = WF \; x \; MSS \quad (9)$$

where,

WF : the weight of the factors obtained,

MSS : the average value of the customer's performance level.

e. Calculating *the Customer Satisfaction Index* (CSI)

This value is obtained by adding up all *the Weight Score* (WS) and then converting it into the percentage shown in Equation (10).

$$CSI = \frac{\sum WS}{HS} \quad (10)$$

where,

$\sum WS$: Total weighted score,

HS : Maximum scale used or *Higest Scale.*

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Metode *Importance Performance Analysis* (IPA)

The *Importance Performance Analysis* (IPA) method is used to identify the priorities for MRT Jakarta service development based on the importance and performance level *of* each service attribute [16]. The results of the analysis are mapped into a cartesian diagram consisting of four quadrants, namely Quadrant A (Main Priority), Quadrant B (Maintain Performance), Quadrant C (Low Priority), and Quadrant D (Excessive) as the basis for the preparation of a strategy for the development of MRT Jakarta facilities and infrastructure [17]. The cartesian *Importance Performance Analysis* (IPA) diagram is presented in **Figure 2.**

Gambar 2. Diagram Kartesius *Importance-Performance Analysis*

The stages in the *Importance-Performance Analysis* (IPA) method are as follows:

a. Calculate average performance scores and expectations

For each attribute, performance level and expectation scores are calculated using Equation (11).

$\bar{X}$ = and = $\frac{\sum X_i}{n}$ $\bar{Y}$ $\frac{\sum Y_i}{n}$ (11)

Where:

$\bar{X}$: Average performance score,
$\bar{Y}$: Average score of interest/expectation level,
$\sum X_i$: Total performance assessment scores/reality,
$\sum Y_i$: Total interest/expectation score;
n : Number of respondents,

b. Calculating the level of conformity (Tki)

The degree of conformity between performance and expectations is calculated using the following Equation (12).

Tki = x 100% $\frac{\sum X_i}{\sum Y_i}$ (12)

Where:

Tki : The level of suitability of the respondents,
$\sum X_i$: Total performance assessment scores/reality,
$\sum Y_i$: Total interest/expectation score.

c. Calculate the overall average performance score and expectations

This step is carried out to obtain an overview of the level of performance and importance of all attributes assessed with Equation (13).

$\bar{\bar{X}}$= and = $\frac{\sum \bar{X}}{k}$ $\bar{\bar{Y}}$ $\frac{\sum \bar{Y}}{k}$ (13)

Where:

$\bar{\bar{X}}$: Average total score of performance/reality assessment,
$\bar{\bar{Y}}$: Average total score of the expectation assessment,
$\sum \bar{X}$: Total average score of performance/statement evaluation,
$\sum \bar{Y}$: Total average score of the expectation assessment,
$\sum X_i$: Total performance assessment scores/reality,
$\sum Y_i$: Total interest/expectation score.
k : Number of question attributes.

d. Visualization in a cartesian diagram

After the average value of the *importance* level and performance level of each attribute are calculated, all attributes are mapped into a Cartesian *Importance Performance Analysis* (IPA) diagram based on the *crosshair*. The mapping results group the attributes into four quadrants, namely Quadrant A (Main Priority), Quadrant B (Maintain

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Performance), Quadrant C (Low Priority), and Quadrant D (Excessive) as the basis for determining service development priorities.

Development Strategy Formulation

The formulation of the MRT Jakarta facilities and infrastructure development strategy is carried out through the integration of the results of the Customer Satisfaction Index (CSI) and Importance Performance Analysis (IPA). The CSI value is used to describe the overall level of user satisfaction, while the IPA is used to identify service attributes based on the level of importance and the level of performance. The next development strategy is prepared based on the position of attributes in the Cartesian diagram of the IPA, by prioritizing attributes in Quadrant A (Main Priority), maintaining attributes in Quadrant B (Maintain Performance), evaluating attributes in Quadrant C (Low Priority), and optimizing attributes in Quadrant D (Excessive) as the basis for the preparation of recommendations for MRT Jakarta service development.

3. DISCUSSION RESULTS

Data Instrument Quality Testing

Instrument quality testing is carried out through validity tests and reliability tests before CSI and IPA analysis is carried out.

Validity Test

The results of the validity test for the assessment of performance and importance in the infrastructure and facilities of the Jakarta MRT are presented in **Table 4** to **Table 7.**

Table 4. MRTJ Infrastructure Performance Assessment Validity Test

MRT Jakarta Infrastructure Performance Assessment			
Item	Calculation	Table	Remarks
STA-SLM1	0.805	0.0981	Valid
STA-SLM2	0.811	0.0981	Valid
STA-SLM3	0.841	0.0981	Valid
STA-SLM4	0.838	0.0981	Valid
STA-AMN1	0.866	0.0981	Valid
STA-AMN2	0.858	0.0981	Valid
STA-AMN3	0.847	0.0981	Valid
STA-AMN4	0.886	0.0981	Valid
STA-AND1	0.854	0.0981	Valid
STA-AND2	0.841	0.0981	Valid
STA-AND3	0.825	0.0981	Valid
STA-AND4	0.894	0.0981	Valid
STA-AND5	0.872	0.0981	Valid
STA-AND6	0.854	0.0981	Valid
STA-AND7	0.851	0.0981	Valid
STA-NYM1	0.859	0.0981	Valid
STA-NYM2	0.878	0.0981	Valid
STA-NYM3	0.821	0.0981	Valid
STA-NYM4	0.831	0.0981	Valid
STA-NYM5	0.841	0.0981	Valid
STA-NYM6	0.848	0.0981	Valid
STA-NYM7	0.880	0.0981	Valid
STA-MDH1	0.884	0.0981	Valid
STA-MDH2	0.868	0.0981	Valid
STA-MDH3	0.885	0.0981	Valid
STA-MDH4	0.886	0.0981	Valid
STA-STR1	0.855	0.0981	Valid

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Table 5. Validity Test of MRTJ Facility Importance Assessment

Assessment of the Importance of MRT Jakarta Infrastructure			
Item	Calculation	Table	Remarks
STA-SLM1	0.855	0.0981	Valid
STA-SLM2	0.881	0.0981	Valid
STA-SLM3	0.917	0.0981	Valid
STA-SLM4	0.912	0.0981	Valid
STA-AMN1	0.918	0.0981	Valid
STA-AMN2	0.904	0.0981	Valid
STA-AMN3	0.926	0.0981	Valid
STA-AMN4	0.920	0.0981	Valid
STA-AND1	0.922	0.0981	Valid
STA-AND2	0.895	0.0981	Valid
STA-AND3	0.875	0.0981	Valid
STA-AND4	0.917	0.0981	Valid
STA-AND5	0.928	0.0981	Valid
STA-AND6	0.916	0.0981	Valid
STA-AND7	0.936	0.0981	Valid
STA-NYM1	0.910	0.0981	Valid
STA-NYM2	0.908	0.0981	Valid
STA-NYM3	0.899	0.0981	Valid
STA-NYM4	0.896	0.0981	Valid
STA-NYM5	0.881	0.0981	Valid
STA-NYM6	0.907	0.0981	Valid
STA-NYM7	0.907	0.0981	Valid
STA-MDH1	0.925	0.0981	Valid
STA-MDH2	0.916	0.0981	Valid
STA-MDH3	0.892	0.0981	Valid
STA-MDH4	0.882	0.0981	Valid
STA-STR1	0.864	0.0981	Valid

Table 6. Validity Test of MRTJ Facility Performance Assessment

Jakarta MRT Facility Performance Assessment			
Item	Calculation	Table	Remarks
KRT-SLM1	0.805	0.0981	Valid
KRT-SLM2	0.811	0.0981	Valid
KRT-SLM3	0.841	0.0981	Valid
KRT-AMN1	0.838	0.0981	Valid
KRT-AMN2	0.866	0.0981	Valid
KRT-AMN3	0.858	0.0981	Valid
KRT-AND1	0.847	0.0981	Valid
KRT-AND2	0.886	0.0981	Valid
KRT-AND3	0.854	0.0981	Valid
KRT-AND4	0.841	0.0981	Valid
KRT-NYM1	0.825	0.0981	Valid
KRT-NYM2	0.894	0.0981	Valid
KRT-NYM3	0.872	0.0981	Valid
KRT-NYM4	0.854	0.0981	Valid
KRT-NYM5	0.851	0.0981	Valid
KRT-MDH1	0.859	0.0981	Valid
KRT-MDH2	0.878	0.0981	Valid
KRT-MDH3	0.821	0.0981	Valid
KRT-STR1	0.831	0.0981	Valid

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Table 7. Validity Test of MRTJ Facility Importance Assessment

Jakarta MRT Facilities Importance Assessment			
Item	Calculation	Table	Remarks
KRT-SLM1	0.907	0.0981	Valid
KRT-SLM2	0.908	0.0981	Valid
KRT-SLM3	0.918	0.0981	Valid
KRT-AMN1	0.944	0.0981	Valid
KRT-AMN2	0.913	0.0981	Valid
KRT-AMN3	0.944	0.0981	Valid
KRT-AND1	0.916	0.0981	Valid
KRT-AND2	0.930	0.0981	Valid
KRT-AND3	0.903	0.0981	Valid
KRT-AND4	0.923	0.0981	Valid
KRT-NYM1	0.929	0.0981	Valid
KRT-NYM2	0.912	0.0981	Valid
KRT-NYM3	0.927	0.0981	Valid
KRT-NYM4	0.903	0.0981	Valid
KRT-NYM5	0.916	0.0981	Valid
KRT-MDH1	0.929	0.0981	Valid
KRT-MDH2	0.945	0.0981	Valid
KRT-MDH3	0.932	0.0981	Valid
KRT-STR1	0.923	0.0981	Valid

Reliability Test

The results of the reliability test showed that the performance and importance assessment instruments in the infrastructure and facilities of the Jakarta MRT had a good level of reliability. The test results are presented in **Table 8** and **Table 9**.

Table 8. Reliability Test Based on MRTJ Infrastructure

Variabel	*Cronbach's Alpha*	Remarks
Performance Appraisal	0.986	Reliabel
Importance Assessment	0.991	Reliabel

Table 9. Reliability Test Based on MRTJ Facilities

Variabel	*Cronbach's Alpha*	Remarks
Performance Appraisal	0.984	Reliabel
Importance Assessment	0.990	Reliabel

Analisis *Customer Satisfication Index* (CSI)

The *Customer Satisfaction Index* (CSI) analysis was carried out to measure the level of user satisfaction with the Jakarta MRT Infrastructure service. The results of the CSI calculation are presented in **Table 10.**

Table 10. MRT Infrastructure Achievement Results Based on *Customer Satisfaction Index* (CSI) Method

Item (Performance)	MSS	Item (Interest)	MIS	WF	WS
K1	4.19	H1	4.61	3.73	15.64
K2	4.16	H2	4.58	3.71	15.41
K3	4.19	H3	4.58	3.71	15.53
K4	4.17	H4	4.58	3.71	15.47
K5	4.19	H5	4.58	3.71	15.52
K6	4.16	H6	4.57	3.70	15.41
K7	4.26	H7	4.60	3.72	15.88
K8	4.17	H8	4.58	3.71	15.47
K9	4.18	H9	4.58	3.71	15.51
K10	4.08	H10	4.55	3.69	15.05
K11	4.11	H11	4.56	3.69	15.16
K12	4.15	H12	4.58	3.71	15.38

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Item (Performance)	MSS	Item (Interest)	MIS	WF	WS
K13	4.21	H13	4.58	3.71	15.62
K14	4.19	H14	4.59	3.71	15.55
K15	4.18	H15	4.58	3.71	15.51
K16	4.17	H16	4.58	3.71	15.46
K17	4.14	H17	4.57	3.70	15.31
K18	4.08	H18	4.54	3.68	15.02
K19	4.11	H19	4.54	3.68	15.11
K20	4.08	H20	4.54	3.68	15.01
K21	4.15	H21	4.56	3.70	15.33
K22	4.13	H22	4.56	3.69	15.25
K23	4.18	H23	4.58	3.71	15.50
K24	4.14	H24	4.58	3.71	15.36
K25	4.18	H25	4.57	3.70	15.47
K26	4.13	H26	4.57	3.70	15.30
K27	4.19	H27	4.59	3.72	15.58
TOTAL	112.26	TOTAL	123.45	WT	415.80

Based on the results of the calculation of *the Customer Satisfaction Index* (CSI), the user satisfaction index value for the Jakarta MRT Infrastructure service was obtained as follows.

$CSI_{\text{MRTJ Station}} = \frac{415.80}{5} = 83.16$

Based on CSI's interpretation criteria for Jakarta MRT Infrastructure, this value is included in the Very Good category.

The results of the CSI calculation for the Jakarta MRT Facilities are then presented in **Table 11.**

Table 11. Results of MRT Facilities Based on *Customer Satisfaction Index* (CSI) Method

Item (Performance)	MSS	Item (Importance)	MIS	WF	WS
K1	4.19	H1	4.59	5.26	22.04
K2	4.14	H2	4.57	5.24	21.70
K3	4.17	H3	4.59	5.27	21.99
K4	4.19	H4	4.59	5.27	22.06
K5	4.16	H5	4.58	5.26	21.87
K6	4.22	H6	4.60	5.28	22.30
K7	4.25	H7	4.59	5.26	22.37
K8	4.21	H8	4.60	5.28	22.24
K9	4.17	H9	4.57	5.25	21.86
K10	4.18	H10	4.57	5.24	21.91
K11	4.20	H11	4.59	5.27	22.14
K12	4.21	H12	4.60	5.28	22.22
K13	4.18	H13	4.57	5.25	21.91
K14	4.10	H14	4.57	5.24	21.49
K15	4.19	H15	4.59	5.26	22.05
K16	4.20	H16	4.58	5.26	22.05
K17	4.25	H17	4.60	5.28	22.45
K18	4.18	H18	4.60	5.27	22.02
K19	4.21	H19	4.59	5.27	22.18
TOTAL	79.58	TOTAL	87.15	WT	418.86

Based on the results of the calculation of *the Customer Satisfaction Index* (CSI), the user satisfaction index value for the Jakarta MRT Infrastructure service was obtained as follows.

$CSI_{\text{Sarana MRTJ}} = \frac{418.86}{5} = 83{,}77$

Based on CSI's interpretation criteria for Jakarta MRT Facilities, this value is included in the Very Good category.

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Analisis *Importance Performance Analysis (*IPA)

The *Importance Performance Analysis* (IPA) was carried out to identify service attributes that are priority development based on the level of importance and user performance level. The results of the IPA calculation on the Jakarta MRT Infrastructure are presented in **Table 12.**

Table 12. MRT Infrastructure Achievement Results Based on *the Importance Performance Analysis* (IPA) Method

Item	Performance (X)	Importance (Y)	Conformity (%)
STA-SLM1	4.19	4.61	91.05
STA-SLM2	4.16	4.58	90.88
STA-SLM3	4.19	4.58	91.39
STA-SLM4	4.17	4.58	91.11
STA-AMN1	4.19	4.58	91.44
STA-AMN2	4.16	4.57	91.14
STA-AMN3	4.26	4.60	92.73
STA-AMN4	4.17	4.58	90.90
STA-AND1	4.18	4.58	91.17
STA-AND2	4.08	4.55	89.73
STA-AND3	4.11	4.56	90.18
STA-AND4	4.15	4.58	90.61
STA-AND5	4.21	4.58	91.88
STA-AND6	4.19	4.59	91.29
STA-AND7	4.18	4.58	91.38
STA-NYM1	4.17	4.58	90.95
STA-NYM2	4.14	4.57	90.59
STA-NYM3	4.08	4.54	89.82
STA-NYM4	4.11	4.54	90.48
STA-NYM5	4.08	4.54	89.98
STA-NYM6	4.15	4.56	90.91
STA-NYM7	4.13	4.56	90.63
STA-MDH1	4.18	4.58	91.27
STA-MDH2	4.14	4.58	90.50
STA-MDH3	4.18	4.57	91.63
STA-MDH4	4.13	4.57	90.33
STA-STR1	4.19	4.59	91.35
TOTAL	112.26	123.45	2455.36
AVERAGE	4.16	4.57	90.94

The analysis of the relationship between the level of performance and the level of user interest in the Jakarta MRT Infrastructure service is presented in **Figure 3**.

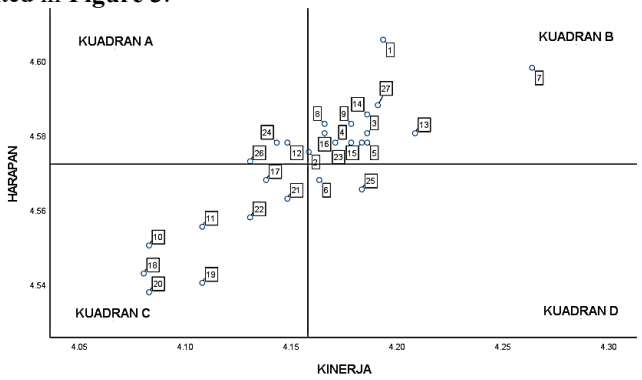

Figure 3. Cartesian Diagram of Performance and Expectations for MRT Jakarta Infrastructure

The results of mapping the service attributes of the Jakarta MRT Infrastructure into four quadrants *of Importance Performance Analysis* (IPA) are summarized in **Table 13.**

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Table 13. Results of Mapping Attributes of Jakarta MRT Infrastructure Services

Quadrant	Attribute Code	Priorities
A	STA-AND4, STA-MDH2, STA-MDH4	Top priorities
B	STA-SLM1, STA-SLM4, STA-AMN1, STA-AMN3, STA-AMN4, STA-AND1, STA-AND5, STA-AND7, STA-NYM1, STA-MDH1, STA-STR1	Retained
C	STA-AND2, STA-AND3, STA-NYM2, STA-NYM7	Low priority
D	STA-AMN2, STA-MDH3	Excessive

The results of the *Importance Performance Analysis* (IPA) on Jakarta MRT Facilities were obtained from a comparison between the level of importance and the level of performance of each service attribute. The results of the calculation are presented in **Table 14.**

Table 14. MRT Facility Achievement Results Based on *the Importance Performance Analysis* (IPA) Method

Item	Performance (X)	Importance (Y)	Conformity (%)
KRT-SLM1	4.19	4.59	91.34
KRT-SLM2	4.14	4.57	90.65
KRT-SLM3	4.17	4.59	90.86
KRT-AMN1	4.19	4.59	91.24
KRT-AMN2	4.16	4.58	90.84
KRT-AMN3	4.22	4.60	91.70
KRT-AND1	4.25	4.59	92.61
KRT-AND2	4.21	4.60	91.59
KRT-AND3	4.17	4.57	91.10
KRT-AND4	4.18	4.57	91.42
KRT-NYM1	4.20	4.59	91.47
KRT-NYM2	4.21	4.60	91.48
KRT-NYM3	4.18	4.57	91.32
KRT-NYM4	4.10	4.57	89.66
KRT-NYM5	4.19	4.59	91.29
KRT-MDH1	4.20	4.58	91.61
KRT-MDH2	4.25	4.60	92.36
KRT-MDH3	4.18	4.60	90.87
KRT-STR1	4.21	4.59	91.63
TOTAL	79.58	87.15	1735.05
AVERAGE	4.19	4.59	91.32

The results of *the Importance Performance Analysis* (IPA) on the Jakarta MRT Facility are visualized in the form of a cartesian diagram as presented in **Figure 4.**

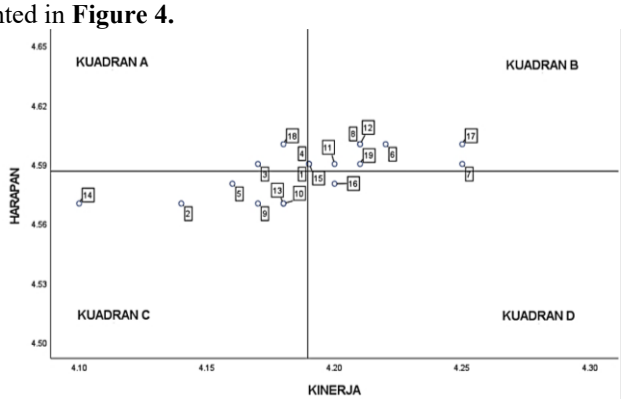

Figure 4. Cartesian Diagram of Performance and Expectations for Jakarta MRT Facilities

The results of mapping the service attributes of the Jakarta MRT Facility into four quadrants *of Importance Performance Analysis* (IPA) are summarized in **Table 15.**

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Table 15. Results of Mapping Attributes of Jakarta MRT Facilities Service

Quadrant	Attribute Code	Priorities
A	KRT-SLM3, KRT-MDH3,	Top priorities
B	KRT-SLM1, KRT-AMN1, KRT-AMN3, KRT-AND1, KRT-AND2, KRT-NYM1, KRT-NYM2, KRT-NYM5, KRT-MDH2, KRT-STR1.	Retained
C	KRT-SLM2, KRT-AMN2, KRT-AND3, KRT-NYM3, KRT-NYM4	Low priority
D	STA-MDH1	Excessive

Infrastructure and Facilities Development Strategy

The results of the analysis show that the *Customer Satisfaction Index* (CSI) value in the infrastructure and facilities aspects of MRT Jakarta is in the Very Good category, which shows that the service in general has been able to meet user expectations. However, the CSI value describes the level of satisfaction in aggregate so that it cannot show service attributes that require specific attention. Therefore, the results of CSI are interpreted together with the results of *the Importance Performance Analysis* (IPA) to identify service attributes that have a high level of importance but have not been optimal. The priority of the development of MRT Jakarta infrastructure and facilities based on the integration of CSI and IPA results is presented in **Table 16.**

Table 16. Jakarta MRT Infrastructure and Facilities Development Strategy Based on the Integration of CSI and Science Results

Components	Development Priorities	*Outcome*
Infrastructure	Improve the reliability of the power backup system through periodic inspections and preventive maintenance.	The station's operational reliability system is improved.
	Develop advanced transportation information that is integrated with other modes of transportation.	Travel connectivity is improving.
	Optimize the delivery of travel disruption information in *real-time*.	Service information is faster and more accurate.
Facilities	Improve safety facilities through periodic evaluations and inspections.	The safety and security of passengers is increased.
	Improved the train serial number identification system to make it easier to identify.	The process of getting on the train is easier and more efficient.

4. CONCLUSIONS AND SUGGESTIONS

Conclusion

The results of the study showed that the level of user satisfaction with the infrastructure and facilities of MRT Jakarta obtained *a Customer Satisfaction Index* (CSI) value of 83.16% and 83.77%, respectively, which is included in the Very Good category. However, the results of *the Importance Performance Analysis* (IPA) show that there are still several attributes that are development priorities, especially in the aspects of operational reliability, service information, safety facilities, and ease of access to information.

The integration of CSI and IPA methods results in a more targeted development strategy through measuring satisfaction levels and identifying priority attributes based on the level of importance and performance. The results of this integration are the basis for prioritizing the improvement of the quality of MRT Jakarta services.

Suggestions

PT MRT Jakarta is advised to prioritize the development of attributes that are in Quadrant A of the science analysis results, without neglecting the maintenance of attributes that have performed well. Further research can develop CSI–IPA integration with multicriteria decision-making methods, such as AHP, Fuzzy AHP, or TOPSIS, to produce more objective and comprehensive development priorities.

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