CSI and IPA Methods for Analysizing Train Passenger Satisfaction at Sidoarjo Station

Akhmat Irfandi[1], Theresia Maria Chandra Agusdini[2], Kurnia Hadi Putra[3], Ratih Sekartadji[4]
[1234] *Civil Engineering Department, Civil Engineering and Planning Faculty, Adhi Tama Institute of Technology Surabaya*
[1]ipankbibank@gmail.com, [2]theresiamca@itats.ac.id, [3]Kurnia_putra@itats.ac.id, [4]ratih.sekartadji@itats.ac.id

Abstract. *The high level of public interest in railway transportation occurs due to its effectiveness as a mode of mass transit for both long and short distances, supporting a wide range of economic and social activities. Trains are capable of transporting large volumes of goods and accommodating significant numbers of passengers. This study aims to examine the characteristics of passengers utilizing train services at Sidoarjo Station and to evaluate their satisfaction with the quality of services provided by station management. The research employs the Customer Satisfaction Index (CSI) and Importance Performance Analysis (IPA) methods and to determine that Sidoarjo Station falls under the classification of a medium class station. Primary data were collected through the distribution of questionnaires to 100 randomly selected respondents, using variables that include tangibles, reliability, responsiveness, empathy, and assurance. The results show that the Customer Satisfaction Index (CSI) score is 73.18%, which falls under the category of "satisfied" passengers with the services provided. The Importance Performance Analysis (IPA) indicates that the sub-variables falling into Quadrant I, which require immediate improvement, are the availability of ATM machines, the cleanliness of prayer room (mushola), and the addition of toilet facilities. Sidoarjo Station has met the criteria to be classified as a medium class station in accordance with the Minister of Transportation Regulation Number: PM.33 of 2011 Article 15.*

Keywords: *Customer Satisfaction Index, Importance Performance Analysis, Passenger Satisfaction, Service Quality, Sidoarjo Station*

1. Introduction

Trains are one of the public transportations which capable to take large numbers of passengers and delivering quantities of goods. Trains are also able to reach far and nearby route (Kurniawan, Y. N. Ihsan, 2023). Trains contribute in reducing the traffic in the city as well as helping the social and economy growth around it (Hudayat, 2022). According to the Law of Republic Indonesia about Railways No. 23 2007, railways is the part of national transportation system which has the character as a mode of mass transortation that have its own specialty that complement each other with other modes of transportation. Various infrastructure facilities such as stations are needed to support the railway's smooth operation. The station is beneficial for train stops which the place for getting on and off passengers including loading and unloading goods (T.N.P. Galuh and S.Sahara, 2023). In case to fulfill the passengers' satisfaction and expectations, stations are required to pay attention to security, safety, and comfort in the station.

According to the Regulation of the Minister of Transportation No. PM.33 2011, stations are divided into three types: (1) Passenger tations (Serving passenger boarding and alighting activities), (2) Goods stations (Loading and unloading logistics, (3) Operational stations (As the center of operational control). Moreover, station classification is also determined based on credit score assessment (maximum of 100 points) which is divided into six aspects. According to the same regulation, those aspects including number of passengers, traffic frequency, number of routes, supporting facilities, operational facilities, and number of goods. Based on total credit score, stations are can be classified into large stations (>70 points), medium (50-70 points), and small (<50 points).

Meanhwile, the service quality is the form of real service from individuas or companies in fulfilling the passengers' expectations, and reflects the company's ability to provide good service compared to competitiors (Tjiptono, 2020). The quality of service includes company reputation, technical quality (price and punctuality), and functional quality (officer attitudes and ease of service access). There are ten dimensions of quality that companies must pay attention to achieve the optimal service: (1) Accuracy, (2) Courtesy, (3) Responsibilty, (4) Ease of access, (5) Service completeness, (6) Variety of models, (7) Punctuality, (8) Personal quality service, (9) Comfort, and (10) Other supporting attributes. These dimensions are the imortant guidelines in realizing the optimal service to fulfill the passengers' expectations towards railway transportation services.

Trains play an essential role as an effective and affordable mass public transportation mode. Trains are now a popular alternative mode of transportation in Indonesia, either for business, social, and personal purposes. Its main advantage is the ability of this mode to transport many people and goods with relatively more predictable travel times and less traffic. Train stations are an essential part of the railway system infrastructure. Besides being as a location for passenger arrivals and departures, stations also

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distribute goods. One of the class 1 stations in the operational area of DAOP VIII Surabaya is Sidoarjo Station, located in Sidoarjo Regency, East Java. Since it was first opened in 1878, this station has changed periodically. The number of passengers using Sidoarjo Station increases over time, especially in recent years. However, the improvements in station facilities and service quality have not fully balanced with the increase in the number of passengers.

Initial observations showed a number of service areas that were considered less satisfied, such as parking layout, waiting room comfort, lack of toilets in public areas, and the absence of easily accessible signs. These factors can affect the passengers' satisfaction. Service customers will be less satisfied with the service they receive if their desires and expectations are not fulfilled properly. Service quality is an important indicator in assessing the performance of service providers. To measure the quality of service expected by passengers, there are five indicators of service quality that later be used as the framework to obtain the data for this research (Laksana, 2018):

(1) Tangible: Physical appearance, equipment, staff, and communication materials used.
(2) Responsiveness: Willingness to provide assistance to passengers with prompt and good service.
(3) Reliability: Ability to provide accurate, punctuality, and reliable service.
(4) Assurance: Knowledge, courtesy, and personal skills that can be trusted.
(5) Empathy: Ability to understand and recognize the needs of individual passengers.

In order to determine the quality of Sidoarjo Station's services to fullfill the passengers' expectations, an appropriate assessment technique is needed. Importance Performance Analysis (IPA) is one approach that is often used in studies on customer happiness. IPA assesses various aspects of service based on their performance and relevance, then divides the results into four quadrants on a Cartesian diagram. Researcher can use these quadrants to determine which characteristics need to be maintained, which are performing better, and which are prioritized for improvement.

Furthermore, Customer Happiness Index (CSI) is another tool used to measure customer happiness. CSI is a quantitative summary of customer satisfaction levels. The importance and satisfaction levels of each service attribute are combined to create this index, which produces a single aggregate value that represents the overall level of satisfaction. Several previous studies have also used IPA and CSI techniques in the context of railway station services, such as previous studies at Manggarai Station and Bandung Station (Herman, 2022; T.N.P. Galuh and S.Sahara, 2023). This study demonstrates the effectiveness of this combined approach in identifying service areas that require improvement. The research at Manggarai Station, the passenger satisfaction score was 70.1%. Meanwhile, at Bandung Station, the service was not satisfied enough, requiring improvement in all aspects. Based on the research, researchers can compare that stations located in big district also still need to improve the quality of their services, as the researcher's goal is to analyze what service aspects need to be improved at Sidoarjo Station.

This study aims to identify the quality of service at Sidoarjo Station based on passenger perceptions and expectations, taking into consideration of the need for improving public services and the importance of user-based data. Expected outcomes may include suggestions for station managers on how to improve service standards and provide a better experience for train passengers.

2. Method

This study used a quantitative descriptive method to assess the level of service at Sidoarjo Station based on passenger expectations and perceptions. The purpose of data collection is to provide a comprehensive picture of the level of satisfaction of train service consumers with the services provided by station management. This study was conducted at Sidoarjo Station which is part of the operational area of DAOP VIII Surabaya, East Java. The population of this study was all passengers according to 2024 data who used Sidoarjo Station as a departure or arrival point, which was 1,094,955 people. Researcher used the Slovin formula with a 10% error rate to determine the number of respondents so that a sample of 100 people was obtained. The research was conducted 5 days in all area of Sidoarjo Station. The data was gathered in the morning, afternoon, and evening.

Customer Satisfaction Index (CSI) is the first method used to analyze the collected data. The CSI calculation is done by adding up the results of the multiplication of the importance and satisfaction values of each attribute, divided by the total importance value, then multiplied by 100%. The second technique is Importance Performance Analysis (IPA), which divides service attributes into four quadrants in a Cartesian diagram and compares the level of passenger expectations and performance (reality) to

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determine which service areas should be prioritized for improvement, maintaining good performance, or avoiding resource allocation to less significant aspects.

3. Results and Discussion

This study began with a validity and reliability test of the questionnaire instrument used to measure passenger satisfaction and expectations of services at Sidoarjo Station. There were 18 statement items that were studied using the estimated r value and compared with the r table of 0.1654 (df = 98, α = 0.1). Based on the results of the validity test, all items were considered original because the calculated r value was greater than the r table value. The reliability test was carried out using the Cronbach Alpha formula and the results showed that the questionnaire was reliable because the alpha value was greater than the lower limit of 0.6. This ensures that the tool used to measure respondents' perceptions is reliable and consistent. 100 train passengers at Sidoarjo Station who were randomly selected during the survey period became the research respondents. The results showed that the characteristics of active passengers were dominated by women (53%), aged 21–30 years (36%), with a high school education (42%), working in a private company (26%), and earning Rp2,000,000–Rp4,000,000 (32%).

Data Analysis using CSI (*Customer Satisfaction Index*) Method

The CSI (Customer Satisfaction Index) method is used to determine the level of satisfaction of train passengers at Sidoarjo Station with the level of reality and expectations of the service variables provided by the management of Sidoarjo Station. The following are the stages in determining the value of the CSI, the first is to calculate the value of the Mean Importance Score (MIS) and also calculate the value of the Mean Satisfaction Score (MSS), then continue by calculating the amount of Weight Factor (WF), then find the value of Weight Score (WS) and the last is to determine the value of CSI.

Table 1. The Calculation MIS, MSS, WF, and WS Values

No.	Statements Variable	MIS	MSS	WF	WS
Tangible					
1.	The waiting room and platform facilities are clean and tidy.	4,16	3,89	5,563	21,64
2.	There are prayer room facilities, toilets, and smoking areas in the platform area and in the front waiting room area.	4,2	3,43	5,616	19,265
3.	Availability of information regarding train departure and arrival schedules.	4,16	3,86	5,563	21,473
4.	The officers managing Sidoarjo Station look attractive.	4,09	3,89	5,469	21,276
5.	Availability of automated teller machines (ATMs).	4,33	2,18	5,79	12,623
6.	Availability of facilities for people with disabilities (special needs).	4,09	3,53	5,469	19,307
Reliability					
7.	Officers provide fast and good service at the ticket counter and ticket printing (boarding pass) area.	4,13	3,9	5,523	21,539
8.	Officers have the ability to quickly and accurately answer questions from passengers.	4,15	3,94	5,55	21,865
9.	There are officers who are able to speak foreign languages (English)	4,07	3,42	5,443	18,614
Responsiveness					
10.	Officers are able to provide a quick and good response to complaints and difficulties experienced by passengers.	4,15	3,81	5,55	21,144
11.	Availability of fast and accurate information on train arrivals or train delays.	4,15	3,97	5,55	22,032
12.	Fast and good service when there is a queue or when passenger volume increases.	4,13	3,66	5,523	20,214
Emphaty					
13.	Officers are able to recognize and understand the needs of passengers individually (e.g, being responsive to passengers who are sick or disabled).	4,13	3,71	5,523	20,49
14.	There are health facilities for passengers.	4,14	3,34	5,536	18,491
Assurance					
15.	The presence of security officers and security posts, as well as safety facilities in the station (e.g, fire extinguishers / APAR).	4,16	4,01	5,563	22,308
16.	There are CCTVs inside and outside the station.	4,19	4,02	5,603	22,524

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17.	There are instructions for passenger evacuation routes or what could be called safe gathering points in the event of a disaster.	4,17	3,64	5,576	20,298
18.	Security officers are able to respond quickly and well if a crime occurs in the station area and provide security and safety for passengers.	4,18	3,72	5,59	20,794
TOTAL		74,78	65,92		365,9

The Customer Satisfaction Index value is obtained from the total WS value divided by the Highest Score in this study using the indicator number 5 as the highest number and multiplied by 100%. The following are the results of data analysis from the Customer Satisfaction Index (CSI) value using the formula:

$$CSI = \frac{\sum WS}{HS} \times 100\% = \frac{365,9}{5} \times 100\% = 73,18\%$$

Based on the results of the questionnaire distribution survey at Sidoarjo Station, the CSI value was 73.18%. Therefore, referring to table 1, it shows that train passengers at Sidoarjo Station are satisfied with the service performance provided by the management of Sidoarjo Station. However, there are several notes for improving the quality of service at Sidoarjo Station, such as the unavailability of automated teller machines (ATMs).

Data Analysis using IPA (*Importance Performance Analysis*) Method

Importance Performance Analysis (IPA) is a method to analyze how well the performance of the service provided matches the passengers' expectations. In addition, IPA can also be used to identify areas that need to be improved in service. The following are the stages to determine the results of the IPA method, the first is to calculate the value of the reality and expectations of passengers, variables X and Y, then continue by determining the value of the level of conformity between variables X and Y and the last is to determine the Cartesian diagram

Table 2. The Calculation of Reality and Expectation Values and Level of Appropriateness

No.	Statements Variable	$\bar{Y}$	$\bar{X}$	LA
Tangible				
1.	The waiting room and platform facilities are clean and tidy	4,16	3,89	93,51%
2.	There are prayer room facilities, toilets, and smoking areas in the platform area and in the front waiting room area.	4,2	3,43	81,67%
3.	Availability of information regarding train departure and arrival schedules.	4,16	3,86	92,79%
4.	The officers managing Sidoarjo Station look attractive.	4,09	3,89	95,11%
5.	Availability of automated teller machines (ATMs).	4,33	2,18	50,35%
6.	Availability of facilities for people with disabilities (special needs).	4,09	3,53	86,31%
Reliability				
7.	Officers provide fast and good service at the ticket counter and ticket printing (boarding pass) area.	4,13	3,9	94,43%
8.	Officers have the ability to quickly and accurately answer questions from passengers.	4,15	3,94	94,94%
9.	There are officers who are able to speak foreign languages (English).	4,07	3,42	84,03%
Responsiveness				
10.	Officers are able to provide a quick and good response to complaints and difficulties experienced by passengers.	4,15	3,81	91,81%
11.	Availability of fast and accurate information on train arrivals or train delays.	4,15	3,97	95,66%
12.	Fast and good service when there is a queue or when passenger volume increases.	4,13	3,66	88,62%
Emphaty				
13.	Officers are able to recognize and understand the needs of passengers individually (e.g, being responsive to passengers who are sick or disabled).	4,13	3,71	89,83%
14.	There are health facilities for passengers.	4,14	3,34	80,68%
Assurance				
15.	The presence of security officers and security posts, as well as safety facilities in the station (e.g, fire extinguishers / APAR).	4,16	4,01	96,39%
16.	There are CCTVs inside and outside the station.	4,19	4,02	95,94%

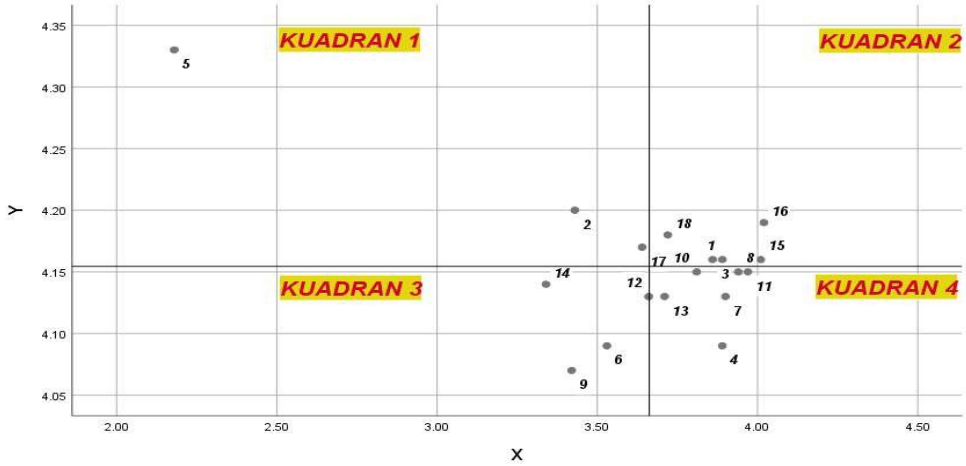
17.	There are instructions for passenger evacuation routes or what could be called safe gathering points in the event of a disaster.	4,17	3,64	87,29%
18.	Security officers are able to respond quickly and well if a crime occurs in the station area and provide security and safety for passengers.	4,18	3,72	89%
TOTAL/AVERAGE		74,78	65,92	88,24%

The results of the table of reality and expectation values show a comparison between passenger perceptions of the service they receive (reality) and the service they expect (expectation) in each subvariable. The average actual value is at 3.66, while the average expected value is at 4.15. This indicates a significant difference, where the service perceived has not fully met passenger expectations.

Furthermore, the comparison of the two values, the level appropriateness (LA) for each subvariable is calculated, the results of which show that the average level of appropriateness is 80.33%, which means that the service has met around 80% of passenger expectations. However, not all attributes have high LA values. Several subvariables such as toilet facilities, prayer rooms, and evacuation instructions have lower LA, indicating that the gap between expectations and reality is quite wide and needs to be fixed immediately. In addition, attributes such as cleanliness of the waiting room, security, and response of officers show high Tki, indicating that the service is in accordance with or exceeds expectations. This analysis is the basis for determining service improvement priorities.

Cartesian Diagram

The Cartesian diagram is divided into four quadrants that show the priority level of each service provided by the Sidoarjo Station management whether there needs to be any improvement or increase in service. Each quadrant is limited by a pair of intersecting lines at point $\bar{X}$ and point $\bar{Y}$. Where the coordinates of point $\bar{X}$ indicate the location of the average level of actual service provided by the Station management and the coordinates of point $\bar{Y}$ indicate the location of the average level of passenger expectations.



Picture 1. Cartesian Diagram

Table 3. Mapping of Diagram Cartesian Diagram's Result

Quadrant 1	2. There are prayer room facilities, toilets, and smoking areas in the platform area and in the front waiting room area. 5. Availability of automated teller machines (ATMs) 17. There are instructions for passenger evacuation routes or what could be called safe gathering points in the event of a disaster.
Quadrant 2	1. The waiting room and platform facilities are clean and tidy. 3. Availability of information regarding train departure and arrival schedules 8. Officers have the ability to quickly and accurately answer questions from passengers. 15. The presence of security officers and security posts, as well as safety facilities in the station (e.g, fire extinguishers / APAR). 16. There are CCTVs inside and outside the station. 18. Security officers are able to respond quickly and well if a crime occurs in the station area and provide security and safety for passengers.
Quadrant 3	6. Availability of facilities for people with disabilities (special needs). 9. There are officers who are able to speak foreign languages (English). 12. Fast and good service when there is a queue or when passenger volume increases. 14. There are health facilities for passengers.
Quadrant 4	4. The officers managing Sidoarjo Station look attractive.

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	7. Officers provide fast and good service at the ticket counter and ticket printing (boarding pass) area. 10. Officers are able to provide a quick and good response to complaints and difficulties experienced by passengers. 11. Availability of fast and accurate information on train arrivals or train delays. 13. Officers are able to recognize and understand the needs of passengers individually (e.g, being responsive to passengers who are sick or disabled).

Quadrant I: Concetrate

This quadrant includes service aspects that are essential for passengers but own a low level of satisfaction which these aspects need to be improved. The three subvariables included in this quadrant are: (1) availability of prayer room facilities, toilets, and smoking areas; (2) the presence of ATM machines; and (3) evacuation route instructions and assembly points during disasters. Inadequate toilets and unclean prayer room facilities are the main complaints. Smoking areas are also considered disruptive because they are not well localized. The absence of ATMs makes it difficult for passengers who need cash quickly. In addition, the lack of evacuation instructions is considered dangerous in the event of an emergency. Therefore, station managers need to immediately improve these basic facilities and security to reduce discomfort and significantly increase satisfaction.

Quadrant II: Keep Up The Good Work

This quadrant contains service attributes that have high levels of expectation and performance. This means that passengers consider this aspect important and are satisfied with its current quality. Subvariables included include: cleanliness of the waiting room and platform, speed and accuracy of officers in providing information, security (presence of officers, posts, and safety equipment), CCTV, and quick response of officers to criminal acts. The management has succeeded in optimally meeting passenger expectations in this area. However, to maintain competitive advantage, the quality of service in this quadrant must be continuously maintained and improved, so that customer satisfaction remains stable and even increases.

Quadrant III: Low Priority

Subvariables in this quadrant have equally low levels of expectation and performance, meaning that passengers do not really care about the quality. These include: facilities for people with disabilities, staff ability to speak foreign languages, speed of service during long queues, and availability of health facilities. Although it is not an urgent priority, improvements are still needed, especially for accessibility and basic services for vulnerable groups, so that inclusivity and safety are maintained. Management can consider improving these aspects in the medium term or when resources allow.

Quarant IV: Possible Overkill

This quadrant shows high service performance but is considered less important by passengers. The attributes included are: departure schedule information, attractive appearance of officers, ticket counter service, speed of response to complaints, information on train delays, and empathy for special needs. This means that even though this aspect has been carried out very well by the management, its contribution to increasing customer satisfaction is relatively low. No further improvement is needed in this area, and resources can be diverted to improving other more crucial attributes. However, maintaining performance at a reasonable level is still recommended to maintain a professional image.

The results of the Cartesian diagram analysis result showed the service aspects that really need to be improved or repaired are the availability of prayer room facilities, toilets, smoking areas in the platform area and in the front waiting room area, the availability of ATMs and directions for passenger evacuation routes in the event of a disaster in the Sidoarjo Station area. Therefore it is expected that the management of Sidoarjo Station will immediately make improvements and increase the quality of these services, so that passengers feel satisfied, comfortable and safe while at Sidoarjo Station.

4. Conclusion

Based on the analysis using the Customer Satisfaction Index (CSI) technique, 73.18% of passengers were satisfied, clasified into the “satisfied” group. The data analysis using the Importance Performance Analysis (IPA) method yielded results in quadrant 1. Referring to the Cartesian diagram, the

service aspects that most need improvement include adding more toilet facilities and maintaining their cleanliness, providing smoking areas on the platforms and in the waiting area at the front, maintaining the cleanliness of items in the prayer room, such as prayer mats and mukenahs (prayer robes), providing an automated teller machine (ATM) within Sidoarjo Station, and adding more evacuation route signs for passengers in the event of a disaster. Therefore, Sidoarjo Station management is expected to immediately improve and enhance the quality of these services to ensure passenger satisfaction, comfort, and safety while at Sidoarjo Station. A more comprehensive approach is recommended for future research, such as expanding the SERVPERF method, adding parking lots and multimodal directions to the indicators, and looking at the relationship between other transportation modes at Sidoarjo Station. A more comprehensive approach is expected to produce a deeper understanding of passenger satisfaction and service quality.

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