The Application of Servqual and IPA Methods to Identify Areas for Improvement in Services at Mangggarai Station

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ARTICLE INFORMATION

ABSTRACT

This study aims to assess and improve the quality of service on the Jabodetabek KRL at Manggarai Station which has experienced an increase in the number of passengers and density, especially during peak hours. This increase causes several challenges, including inconvenience for passengers. The SERVQUAL and Important Performance Analysis (IPA) methods were used to identify and address gaps between expectations and passengers' perceptions of the services provided by the station. The study involved the distribution of questionnaires designed to measure five dimensions of service quality including reliability, responsiveness, assurance, empathy, and physical evidence. The results of the analysis proved the existence of several significant gaps that require immediate corrective action. Based on these findings, strategic recommendations were developed for PT Kereta Commuter Indonesia in order to optimize operations and improve customer satisfaction. This research provides new insights into the existing literature by highlighting the importance of service quality management in the public transportation sector, particularly on the KRL Commuter Line.

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1. INTRODUCTION

The people of Greater Jakarta (Jabodetabek) heavily rely on the KRL Commuter Line for their mobility. This is because the KRL offers affordable fares, extensive routes, speed, and the ability to avoid traffic congestion. The KRL has contributed to an increase in the number of passengers. However, this increase has also resulted in overcrowding, especially at Manggarai Station during peak hours, exacerbated by station reconstruction and the removal of several routes, forcing passengers to transit at Manggarai. The inadequate station design and difficult platform transfers have increased discomfort, even prompting some passengers to change their jobs. This issue highlights the need to evaluate service quality from the passengers' perspective to identify and address gaps between expected and actual services and to determine priority improvements that PT KCI must make. The SERVQUAL method is used to measure and analyze the gap between the services passengers expect and the services they actually receive.

This analysis helps in identifying areas of service that require priority improvements (Jazuli et al., 2020). The Importance-Performance Analysis (IPA) method is used to evaluate the service quality attributes important to passengers, allowing researchers to identify which improvement actions should be prioritized. This method is effective in organizing service improvement resources more efficiently and effectively, leading to more precise allocation o f quality improvement efforts (Sampurno & Sharif, 2020).

This study aims to evaluate and improve the service quality of the KRL Commuter Line at Manggarai Station, addressing issues of overcrowding during peak hours and adjusting to route changes and ongoing station construction. The focus is on identifying gaps between passengers' perceptions and expectations of the services provided (Ulfa, 2021). The primary goal of this research is to understand and provide solutions for addressing service gaps and identifying improvement priorities through Important Performance Analysis (IPA). The results of this study are expected to guide PT Kereta Commuter Indonesia in implementing evidence-based solutions to manage overcrowding, improve passenger flow, and enhance efficiency and safety, particularly at Manggarai Station, all with the aim of meeting and exceeding passenger expectations.

2. LITERATURE REVIEW

Public service is one of the efforts provided by an organization or company to the public who use their services. Some examples of public services include hotel services, restaurant services, and public transportation services. Services must be delivered to consumers with excellent quality to ensure good feedback, thus enhancing the company's image among consumers and increasing profits, as stated by (Firdiana, 2018), that quality is one of the key factors in determining consumer satisfaction levels. This aligns with (Br Marbun et al., 2022), who asserts that a company or organization's ability to provide good service to consumers can position the company or organization more favorably in competition with other companies. The quality of service refers to the extent of the gap between the

actual service conditions and the customers' expectations of the service received (Akay et al., 2021). Customer satisfaction derived from public transportation services can influence people to use this mode of transport (Zhang et al., 2019).

The Servqual and IPA methods are widely used to analyze consumer satisfaction levels in various fields. For example, (Wibowo & Muflihah, 2022) conducted research analyzing service quality in relation to consumer satisfaction using the Servqual and IPA methods with the aim of assessing the level of consumer satisfaction with the fitness services they used. The result showed that the tangible dimension scored -0.12, and the service quality score related to consumer satisfaction was more than 1, meaning that consumers were satisfied with the services provided by the fitness company. However, if analyzed using the IPA, there are still several areas that need to improve in quality. Research by Reza Nugraha et al., (2023) also conducted research on measuring satisfaction levels using the Servqual and IPA methods for the service quality provided by a logistics company due to numerous customer complaints about package delays, which impacted the company's revenue. Using these two methods, nine key factors were identified that require improvement recommendations. The authors proposed service improvement suggestions, including enhancing employee training, providing appropriate vehicles, and determining rates based on the distance and weight of the goods.

The Servqual and IPA methods were also used to improve the service quality at a 4-star hotel by (Kusuma et al., 2022). Due to the intense competition in the hospitality industry, the authors proposed improvements to enhance customer satisfaction. Of the 22 attribute questions presented, all showed a negative gap between perception and expectation, indicating that the quality of service provided to consumers was lacking. There were five main priority attributes for improvement, as illustrated by the Cartesian diagram in the IPA method. This research focuses on public transportation services, as ensuring customer satisfaction with public transport is a primary

goal for transportation companies that wish to maintain or increase the number of service users (Esmailpour et al., 2020). Providing public transportation services not only increases the number of users, which can boost revenue, but also enhances the company's image, fosters customer loyalty, and contributes to reducing traffic congestion and air pollution, allowing society to live in a healthier and more comfortable environment.

The Servqual method is widely used because it serves as a method for measuring the quality of service (Wibowo & Muflihah, 2022) by identifying the gap between customer expectations and perceptions (Gunawan, 2022) for each service dimension attribute (Satria, 2019). According to (Zeithaml, 1990), there are five service dimensions: reliability, which emphasizes the company's ability to provide accurate and timely services; responsiveness, related to the employees' ability to quickly respond to customer needs; assurance, referring to the knowledge and courtesy of employees that build trust and security for customers; empathy, reflecting the company's attention to the specific needs of customers; and tangible aspects, involving the physical elements that customers can see, such as facilities and hardware.

The gap model in Servqual consists of five gaps, as shown in Figure 1, according to (Zeithaml, 1990): (1) Gap 1 (Management Perception): This refers to the difference between what consumers expect and what management believes those expectations are. (2) Gap 2 (Quality Specifications): This refers to the difference between management's perception of consumer expectations and the service quality specifications they set. (3) Gap 3 (Service Delivery): This refers to the difference between the service quality specifications and the actual service delivered. (4) Gap 4 (Marketing Communication): This refers to the gap between what the company promises through external communication and the service actually delivered. (5) Gap 5 (Perceived Service): This refers to the difference between the service received and the service expected by the consumer, often resulting from the previous four gaps.
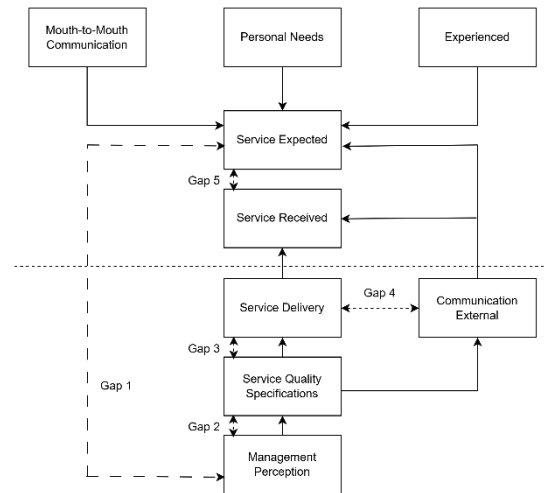

Figure 1. Servqual gap model

The IPA method is used to evaluate and compare the perceived service performance with the level of satisfaction expected by users (Immanuel & Setiawan, 2020) or to determine the importance level of each attribute used (Sihotang & Oktarina, 2022). IPA helps in identifying service attributes that need improvement and serves as a guide for company development (Immanuel & Setiawan, 2020). IPA uses two axes in its analysis: the x-axis shows the average customer satisfaction score for each service attribute, while the y-axis shows the average customer expectation score. The midpoint of these two axes represents the average value of the overall survey data, helping to map areas that need attention in service (Wijaya, 2018) The IPA method can be used to identify gaps in the performance of public transportation service attributes relative to their importance (Esmailpour et al., 2020).

Figure 2. Importance performance analysis map

Based on Figure 2 shows that IPA divides service attributes into four quadrants based on performance and importance levels (Antika, 2023): (1) First Quadrant "Priorities for Improvement": Indicators with low performance but high importance, indicating areas that need improvement because customers consider them important yet their satisfaction is below expectations. (2) Second Quadrant "Keep Up the Good Work": Indicators with high performance and high importance, where services are already good and need to be maintained because they satisfy customers. (3) Third Quadrant "Lowest Priority": Indicators with low performance and low importance, reflecting attributes that are less important to customers and whose performance is not outstanding. (4) Fourth Quadrant "Possible Overkill": Indicators with high performance but low importance, suggesting that resources might be wasted on attributes that customers consider less important, hence these services could be reduced for cost efficiency.

Research by (Esmailpour et al., 2020) used a case study on bus services in Tehran, Iran. This study was conducted to identify the main attributes of bus service in Tehran, introduce confidence intervals around each attribute to aid in the interpretation of results, and segment the sample using Cluster Analysis (CA) to reduce the heterogeneity effects of the results. 15 bus service attributes were evaluated using IPA. The results led to the extraction of four components (comfort, physical comfort, reliability, and security) and the classification of the sample into three groups based on socio-demographic and bus travel characteristics. The IPA results suggest that transport agencies and policymakers need to pay greater attention to improving comfort aspects such as ventilation, cleanliness of buses, and provision of facilities for the elderly/ disabled.

Research (Fawwaz & Rakhmatulloh, 2021) conducted an assessment of service quality for users of Sudirman Station. The results showed that users are satisfied with the intermodal integration at the Dukuh Atas Area, but there are still issues such as inaccurate KRL train schedules and availability of disability facilities, which have not yet provided satisfaction to users and require improvements. These improvements should include providing updated information related to train arrival schedules and estimated delays, as well as live positioning. Additionally, provisions should be made for disabled seating, ramps, guiding blocks, and elevators.

The research gaps identified in the literature review suggest a need for deeper exploration into several key areas of service quality within urban transportation systems. There's a significant opportunity for research that specifically addresses how service quality measures like SERVQUAL and IPA are adapted to highly congested settings like Manggarai Station during peak hours. Additionally, the combined application of these methods in such environments, as well as the integration of advanced technologies like real-time analytics and AI, remain underexplored. Studies on how the physical design of transportation hubs impacts service quality and the emotional and psychological responses of commuters to service factors like overcrowding also present areas ripe for further investigation. These gaps highlight essential areas for future research that could improve the understanding and enhancement of service quality in urban public transport systems.

3. RESEARCH METHOD

Research methods are a crucial part because they serve as a foundation for describing the research as a whole. In this study, a framework is used because it helps establish clear guidelines for conducting the study. Figure 3 is an image of the framework used in this research.
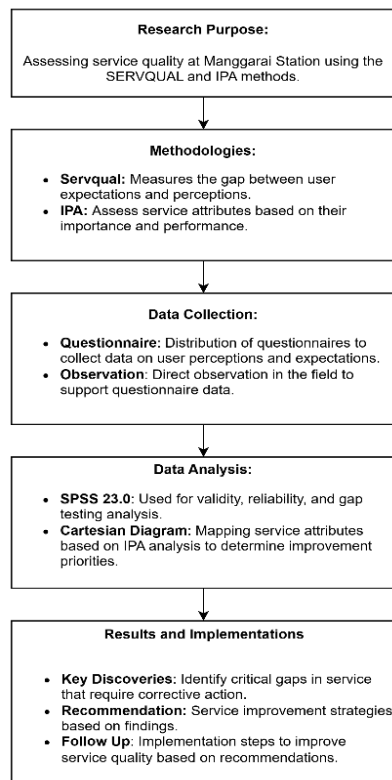
Figure 3. Study framework

Primary and secondary data were used in this research to achieve the research objectives. Primary data were obtained directly from respondents using questionnaires and observations, which is supported by (Firdiana, 2018), stating that to obtain an assessment result in services, surveys or direct field interviews with KRL users are facilitated, in the form of feedback such as suggestions and criticisms for PT. KAI. The questionnaire consists of 31 attribute questions (Table 1) and is divided into 5 categories of variables. This research survey covers the variables of Responsiveness, Reliability, Empathy, Assurance, and Tangibles. These variables help assess the customers' actual perception (Perceived Value) and their expectations (Expected Value) regarding the service quality of the KRL Commuter Line. Secondary data include literature review and theoretical framework obtained from various sources such as university libraries, companies, books, and previous relevant literature related to the study object. Secondary data were used to complement and support the analysis of primary data.

The sample size was determined based on the average daily number of KRL users from January 2023 to March 2023, totaling 752,078.333 respondents. The purposive sampling method was used to determine the sample size with characteristics aligned with the research objectives, ensuring effective answers to the research questions. The Slovin formula was used to calculate the sample size with a 10% or 0.1 error rate, using the following formula (Majdina et al., 2024):

$$n = \frac{N}{1 + Ne^2} = \frac{752.078.333}{1 + 752.078.333(0,1)^2}$$
$$= \frac{752.078.333}{7521,783}$$
$$= 99,98$$
$$= 100$$

Thus, 100 KRL Commuter Line users at Manggarai Station were used as respondents in this study.

The initial stage of the research involved the preparation and distribution of questionnaires consisting of 31 attribute questions to 100 respondents who were workers transiting at Manggarai Station during peak hours to collect data on their perceptions of service quality. The purpose of selecting this criterion was to obtain accurate assessments based on users' real experiences. The collected questionnaire results showed that the majority of respondents were aged between 18 and 45 years and were already employed. Bekasi Station was the most common departure station, while Sudirman Station was the most frequent destination. The most common departure times for work were between 06:00 and 07:00 WIB, and the most common return times from work were between 17:00 and 18:00 WIB. This data shows that Manggarai Station becomes crowded starting from 06:00 to 07:00 WIB in the morning and 17:00 to 18:00 WIB in the afternoon, consistent with the findings of (Dewanti et al., 2023) which indicated that Manggarai Station starts getting crowded from 17:00 WIB.

The collected data were analyzed using SPSS 23.0 to test validity and reliability, which serves to check the accuracy and reliability of the instruments in measuring the variables under study. The results of this questionnaire were

used to identify the gap between the expected value and the perceived value of consumers, or the Servqual Gap (Wijaya, 2018), and to calculate the satisfaction score of service quality.

Table 1. questionnaire attribute questions

No	Service Benchmarks
Attribute 1	The ability of staff to provide optimal service to KRL users during peak hours
Attribute 2	Security's ability to manage passengers during peak hours
Attribute 3	Clear information on train arrivals
Attribute 4	Clear information on transit
Attribute 5	KRL arrivals are on schedule
Attribute 6	KRL departures are on schedule
Attribute 7	Ease of access for users when transiting
Attribute 8	Fast service during peak hours
Attribute 9	Relatively short waiting time at the ticket counter
Attribute 10	The ability of staff to serve KRL users well during peak hours
Attribute 11	Users feel helped by the service provided by staff during peak hours
Attribute 12	No racial or ethnic discrimination bby staff toward KRL users
Attribute 13	Security assurance at Manggarai Station
Attribute 14	Supervision by security on every platform during peak hours
Attribute 15	KRL users feel comfortable during peak hours
Attribute 16	KRL users feel safe when transitinf
Attribute 17	Staff appearance is neat and professional
Attribute 18	The train arrival schedule display is active
Attribute 19	High frequency of KRL fleets to accommodate uusers during peak hours
Attribute 20	The design of the pillars at Manggarai Station does not obstruct the evacuation route
Attribute 21	The pedestrian area for KRL users is very adequate
Attribute 22	Escalators operate during peak hours
Attribute 23	Escalators can accommodate many KRL users during peak hours
Attribute 24	Safe distance between the platform and the train tracks meets technical requirements
Attribute 25	Manggarai station is well maintained interms of cleanliness and orderliness
Attribute 26	Toilets are always kept clean and comfortable
Attribute 27	The prayer room is always kept clean and comfortable
Attribute 28	Prayer equipment is kept clean
Attribute 29	Adequate trash bins are available at every corner of manggarai station
Attribute 30	Wifi network at the station is accessible smoothly, even during peak hours
Attribute 31	Waiting seats are ergonomically designed for user comfort

4. RESULT AND DISCUSSION

This study aims to investigate the implementation of Servqual and IPA methods for public service at Manggarai Station.

4.1 Servqual

The validity test was conducted with a 5% error rate, using an R-table value of 0.1654. A question in the questionnaire is considered valid if its calculated correlation value (R-calculated) is higher than the R-table correlation value (R-table). The validity of an attribute assesses whether the attribute accurately measures what it is supposed to measure, ensuring the reliability of the research results.

Table 2. Validity test

No	R_{count} Performanced	R_{count} Expected	R_{count} Impotant	R_{table}	Results
Attribute 1	0.472	0.533	0.44	0.1654	Valid
Attribute 2	0.506	0.587	0.446	0.1654	Valid
Attribute 3	0.389	0.409	0.457	0.1654	Valid
Attribute 4	0.467	0.477	0.414	0.1654	Valid
Attribute 5	0.488	0.565	0.397	0.1654	Valid
Attribute 6	0.479	0.664	0.313	0.1654	Valid
Attribute 7	0.613	0.743	0.429	0.1654	Valid
Attribute 8	0.624	0.716	0.611	0.1654	Valid
Attribute 9	0.323	0.528	0.334	0.1654	Valid
Attribute 10	0.617	0.705	0.349	0.1654	Valid
Attribute 11	0.640	0.679	0.642	0.1654	Valid
Attribute 12	0.577	0.508	0.506	0.1654	Valid

Attribute 13	0.624	0.733	0.408	0.1654	Valid
Attribute 14	0.530	0.687	0.65	0.1654	Valid
Attribute 15	0.676	0.705	0.579	0.1654	Valid
Attribute 16	0.659	0.73	0.473	0.1654	Valid
Attribute 17	0.418	0.353	0.342	0.1654	Valid
Attribute 18	0.623	0.657	0.335	0.1654	Valid
Attribute 19	0.642	0.734	0.21	0.1654	Valid
Attribute 20	0.446	0.564	0.5	0.1654	Valid
Attribute 21	0.668	0.78	0.367	0.1654	Valid
Attribute 22	0.593	0.634	0.501	0.1654	Valid
Attribute 23	0.526	0.614	0.441	0.1654	Valid
Attribute 24	0.569	0.67	0.499	0.1654	Valid
Attribute 25	0.486	0.573	0.307	0.1654	Valid
Attribute 26	0.575	0.683	0.167	0.1654	Valid
Attribute 27	0.592	0.702	0.495	0.1654	Valid
Attribute 28	0.570	0.736	0.6	0.1654	Valid
Attribute 29	0.421	0.627	0.553	0.1654	Valid
Attribute 30	0.401	0.532	0.41	0.1654	Valid
Attribute 31	0.553	0.696	0.606	0.1654	Valid

The table 2 shows the results of the validity test, which demonstrate that each question attribute in the survey has been proven valid at various levels, including performance, expectations, and importance. This is because the calculated correlation value is greater than the table correlation value, meaning that the attributes in the questionnaire can be considered reliable.

The reliability test of the questionnaire is an important factor to ensure that the measured attributes are reliable. By conducting a reliability test, we can identify and address potential issues. Unreliable attributes tend to result in biased data, which will affect the validity of the research. A benchmark is considered reliable if its Cronbach's Alpha value is greater than 0.6. However, if the reliability value is less than 0.6, it is considered unreliable. The results of this study show reliability for all three benchmarks. The following is the reliability test table.

Table 3. Reliability test

Indicator	Cronbach's Alpha	Result
Performanced	0,933	Reliable
Expected	0,956	Reliable
Important	0,898	Reliable

After conducting the validity test and reliability test on the data obtained, the next step is to find the gap value, which is done by subtracting the performance value and the expectation value. The following table 3 presents the results showing several attributes with negative gap, a negative gap value means that the consumer's perception of the quality of service received is lower than their expectations. This means customers feel that the service they received does not meet the expectations they had formed. Positive gap values indicates a discrepancy where the consumer's perception of the quality of service received exceeds their expectations. Simply put, customers feel that the service they received is better than what they expected.

Table 4. Servqual result

No	Performance	Expectation	Gap	Priority
Attribute 1	396	407	-11	15
Attribute 2	415	415	0	4
Attribute 3	415	416	-1	5
Attribute 4	420	416	4	1
Attribute 5	353	380	-27	23
Attribute 6	364	382	-18	17
Attribute 7	304	353	-49	31
Attribute 8	347	382	-35	27
Attribute 9	291	316	-25	22
Attribute 10	394	396	-2	6
Attribute 11	385	405	-20	20
Attribute 12	428	432	-4	8

Attribute 13	338	367	-29	24
Attribute 14	411	408	3	3
Attribute 15	313	345	-32	25
Attribute 16	336	354	-18	17
Attribute 17	419	426	-7	10
Attribute 18	401	411	-10	13
Attribute 19	379	375	4	1
Attribute 20	324	330	-6	9
Attribute 21	336	369	-33	26
Attribute 22	355	391	-36	28
Attribute 23	329	350	-21	21
Attribute 24	370	372	-2	6
Attribute 25	374	388	-14	16
Attribute 26	370	379	-9	11
Attribute 27	380	390	-10	13
Attribute 28	340	359	-19	19
Attribute 29	377	386	-9	11
Attribute 30	279	316	-37	30
Attribute 31	337	373	-36	28

The Servqual results show that several attributes, such as Attribute 13 and Attribute 22, have significant negative gaps with high priority for improvement, indicating that these areas should be the main focus for enhancement. Although Attribute 7 has a lower gap, its high priority indicates that improving it could have a substantial impact on user satisfaction. Some attributes, such as Attribute 25 and Attribute 18, show negative gaps but with lower priority, indicating that these issues are less critical. These results highlight the importance of focusing on security and schedule accuracy as improvement priorities to enhance overall user satisfaction at Manggarai Station.
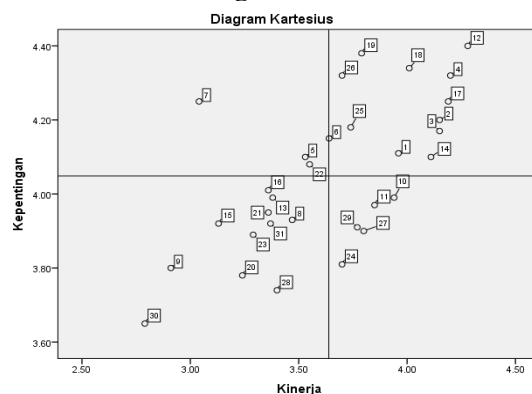
4.2 Cartesian Diagram

Figure 4. Cartesian diagram

The Cartesian Diagram is part of the IPA method used to map the average performance score (Suhermi et al., 2019) and assess the service quality at Manggarai Station. This diagram plots service attributes based on two dimensions: Performance (X-axis) and Importance (Y-axis). Each number on the diagram represents an attribute that has been identified in the survey. The explanation related to the quadrants of the Cartesian Diagram above is as follows:

1. Quadrant I (top left): Attributes here have high importance but low performance. This indicates critical areas that require immediate improvement because they are important to users but not yet satisfactory. Attributes such as 5, 6, 7, and 22 fall into this quadrant, indicating that these are priority areas for improvement.
2. Quadrant II (top right): Attributes in this area have both high performance and high importance. This shows that the service in these aspects is already good and important to users, so it needs to be maintained. Examples of attributes in this quadrant are 17 and 18, which indicate high user satisfaction with these important aspects.
3. Quadrant III (bottom left): Attributes in this area show both low performance and low importance. Although the performance is unsatisfactory, these attributes are not considered important by users, so improvements in this area can be given lower priority. Attributes such as 30 and 28 fall into this category.
4. Quadrant IV (bottom right): Attributes with high performance but low importance. This area indicates that although the service is good, the efforts made may exceed users'

expectations, offering potential for resource efficiency. Attributes such as 10 and 27 could be considered overkill, where resources might be better allocated to more critical areas.

The IPA analysis using the Cartesian Diagram has several key managerial implications that can help PT. KAI allocate resources more effectively and improve customer satisfaction. First, management should prioritize improvements on attributes in Quadrant I, which indicate areas of high importance but low performance. For example, train arrivals and departures that do not match the scheduled times, passengers who find it easy to switch between platforms, and escalators that operate during peak times. Investment in these areas is expected to significantly increase customer satisfaction.

Second, for attributes in Quadrant II, which have both high performance and high importance to customers, the focus should be on maintaining quality and preventing any decline in standards. Attributes such as numbers 1, 2, 3, 4, 12, 14, 17, 18, 19, 25, and 26. Benchmarks in this quadrant need to be maintained because they provide superior value to KRL Commuter Line users.

Third, Quadrant III, which shows low performance and low importance, does not require significant resource allocation unless there is a change in strategy or consumer demand. Benchmarks in Quadrant III are numbers 8, 9, 13, 15, 16, 20, 21, 23, 28, 30, and 31. Improvements to the benchmarks in this quadrant can be reconsidered based on the perceived benefits to KRL Commuter Line users.

Fourth, attributes in Quadrant IV include Benchmarks numbers 10, 11, 24, 27, and 29. Manggarai Station should reduce the level of performance on the benchmarks included in this quadrant. This indicates the potential for cost reduction by reallocating resources from these over-performing areas to more critical zones, such as Quadrant I.

5. CONCLUSION

This study has identified several critical gaps in services at Manggarai Station, particularly concerning security, cleanliness, and punctuality aspects. From the analysis using SERVQUAL and IPA methods, it has been found that improvements in these aspects can significantly enhance user satisfaction. The main recommendations can be given on the aspects of security, cleanliness, and punctuality. Security is recommended given the high need for better security; we recommend increasing the number of security patrols during peak hours and installing more advanced video surveillance systems. This implementation is expected to reduce users' security concerns while at the station. Regarding cleanliness at the station, as it is one of the factors that greatly affect user perception. Therefore, we suggest that the frequency of cleaning at the station, especially in waiting areas and restrooms, be increased, especially during peak hours. This will not only enhance comfort but also the hygienic standards of the station. The punctuality of trains is a critical factor that often leads to complaints. We suggest optimizing train schedules with better monitoring technology to reduce delays and ensure more accurate and reliable schedules for users.

Implementation steps that can be provided include regular training of employees to enhance awareness and performance in security and cleanliness services. Invest in information technology systems to monitor and optimize train punctuality.

Monitoring and Evaluation are necessary to maintain user satisfaction of commuter trains by establishing and implementing a service performance evaluation system every quarter to measure the effectiveness of the improvement implementations. In addition, conducting periodic user satisfaction surveys to obtain direct feedback from users. The implementation of these recommendations is expected not only to enhance user satisfaction but also to strengthen the image of PT Kereta Commuter Indonesia as a reliable and comfortable train service provider. This will encourage broader use of train services, reduce traffic burdens, and support efforts to reduce

pollution. Through the implementation of strategies focused on enhancing security, cleanliness, and punctuality, we believe that Manggarai Station can improve service standards and meet and exceed user expectations. Close cooperation between the station management team and relevant stakeholders will be key in achieving these objectives.

Suggestions for future research include conducting a comparative study with other stations that may have implemented similar strategies. This could help in understanding the relative success of various actions taken at Manggarai Station compared to other locations. Additionally, further research on the technologies used to enhance punctuality and security, including the effectiveness and reliability of the systems implemented, should be conducted. This research could include an evaluation of the cost and benefits of such technology investments.

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