Advance Sustainable Science, Engineering and Technology (ASSET)
Vol. 8, No.1, January 2026, pp. 0260107-01 ~ 0260107-016
ISSN: 2715-4211 DOI: https://doi.org/10.26877/asset.v8i1.2757

Importance–Performance Analysis of Bus Rapid Transit Service Attributes for Passenger Satisfaction and Sustainability

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Abstract. The Bus Rapid Transit (BRT) system in Bali serves as a vital component of sustainable urban mobility. This study uniquely integrates Importance-Performance Analysis (IPA) with technical recommendations to provide a comprehensive evaluation of BRT performance and its contribution to sustainable transportation. The analysis identifies key service strengths—such as seating comfort, air conditioning, cleanliness, and personnel service quality—that exceed passenger expectations. Conversely, deficiencies are evident in bus stop conditions, accessibility for disabled passengers, punctuality, and environmental sustainability. By linking IPA results with actionable technical strategies, the study recommends upgrading bus stop infrastructure, enhancing accessibility design, implementing real-time scheduling, and tracking systems, transitioning to eco-friendly bus fleets, and strengthening passenger information and security systems. This integrated approach not only highlights priority areas for improvement but also offers a practical roadmap for policymakers and transit authorities to enhance service quality, boost ridership, and advance Bali's progress toward a resilient and sustainable urban transport system.

Keywords: Service Quality Modeling, Public Transport Engineering, Performance Gap Analysis

(Received 2025-09-13, Revised 2025-11-13, Accepted 2025-11-18, Available Online by 2026-01-06)

1. Introduction

The rapid urbanization and increasing demand for mobility have led to significant challenges in urban transportation systems, including traffic congestion, air pollution, and inefficiencies in public transit services [1]. Cities in both developing and developed countries are grappling with these issues, which hinder economic growth and reduce the quality of life for residents [2]. In response, many cities worldwide have turned to Bus Rapid Transit (BRT) systems as a sustainable solution to urban mobility issues [3]. BRT systems offer high-capacity, efficient, and reliable public transportation, which can compete with private vehicle use while promoting environmental sustainability [4]. Additionally, BRT systems have

demonstrated the ability to integrate seamlessly with other modes of public transportation, further enhancing urban mobility.

In Indonesia, particularly in Bali, the BRT systems Trans Metro Dewata and Trans Sarbagita have been implemented to address the growing transportation needs of the Sarbagita metropolitan area, which includes Denpasar, Badung, Gianyar, and Tabanan. These systems operate under a government- supported "Buy the Service" scheme, aiming to provide affordable, accessible, and sustainable transit options [5]. Despite achieving operational performance metrics such as travel time, frequency, and punctuality, these systems struggle with low passenger occupancy rates, which remain below the standard threshold of 70% (Transportation, 2022). This indicates a gap between the system's operational success and public acceptance.

Passenger satisfaction is a critical determinant of public transit success, influencing ridership levels and overall system effectiveness [6]. Research has shown that factors such as reliability, comfort, affordability, and accessibility play vital roles in shaping passenger perceptions [7]. Addressing these factors effectively can help public transit systems attract and retain riders, thereby reducing reliance on private vehicles and contributing to environmental sustainability [8]. Understanding the factors contributing to passenger satisfaction and identifying service attributes requiring improvement are essential for optimizing BRT systems. This study focuses on comparing the performance of BRT systems in Bali, analyzing passenger expectations and satisfaction to determine best practices and areas for enhancement [9].

By employing a comparative approach, this research aims to provide actionable insights for policymakers and transit operators to improve BRT services, enhance user satisfaction, and promote the shift from private to public transportation [10]. The findings also contribute to broader discussions on sustainable urban transportation in both developing and developed city contexts [11]. However, a key research gap remains in transportation engineering studies—particularly in the quantitative identification of BRT performance attributes that are often overlooked in previous IPA-based evaluations. While the Importance-Performance Analysis (IPA) framework has been widely applied in transportation research, its integration with technical and engineering performance indicators (such as infrastructure quality, system reliability, and environmental efficiency) is still limited. Therefore, this study seeks to answer a sharper research question: How can IPA quantitatively identify engineering performance attributes of the BRT system that have not been captured in previous studies? The novelty of this research lies in its contextual application of IPA within a tourism-intensive region like Bali, where urban transport performance must balance service quality, sustainability, and visitor-oriented mobility demands. This paper is organized as follows: Section 2 outlines the methodology employed in data collection and analysis, Section 3 presents the results and discussion, and Section 4 concludes with recommendations for improving BRT performance and passenger satisfaction in Bali [12].

2. **Methods**

2.1 Study Area

This study focuses on two urban regions: the Sarbagita metropolitan area in Bali, Indonesia. The Sarbagita area encompasses Denpasar, Badung, Gianyar, and Tabanan, where the Trans Metro Dewata and Trans Sarbagita BRT systems operate. These systems aim to provide sustainable and efficient public transportation, as highlighted in regional transport policy studies. The geographic and socio-economic contexts of these regions provide a foundation for understanding variations in BRT system performance and passenger satisfaction [13]. This study focuses on the Sarbagita metropolitan area in Bali, Indonesia. The Sarbagita area encompasses Denpasar, Badung, Gianyar, and Tabanan, where the Trans Metro Dewata and Trans Sarbagita BRT systems operate. The geographic and socio-economic contexts of these regions provide a foundation for understanding variations in BRT system performance and passenger satisfaction.

2.2 Data Collection

Primary data were collected through structured questionnaires distributed to BRT passengers in Sarbagita areas. The survey aimed to capture passenger demographics, travel behavior, satisfaction levels, and expectations regarding various service attributes such as reliability, accessibility, comfort, and safety. The questionnaire was designed using a 5-point Likert scale to evaluate passengers' perceptions and

expectations effectively. A total of 336 respondents participated on data collection in Bali. The survey was conducted over a four-week period to ensure sufficient coverage of different times of the day and varying days of the week, as recommended for robust public transit research [14].

Secondary data were obtained from official reports, operator performance records, and relevant government publications. These data included operational statistics, ridership trends, and service quality assessments (Transportation, 2022). Additionally, field observations were conducted to validate the information obtained and provide real-time insights into the functioning of BRT systems (Cervero, 2007).

2.3 Sampling Method and Instrument Test

The study employed a stratified random sampling method to ensure balanced representation across demographic groups and travel patterns [15]. Stratification was based on key variables including age, gender, income level, and frequency of BRT usage, encompassing both regular and occasional passengers [16]. A total of 336 respondents participated, providing sufficient sample adequacy for statistical analysis. Prior to data collection, the questionnaire instrument was tested for validity and reliability to ensure methodological rigor. Validity was assessed using correlation analysis, where each item was required to have a positive correlation coefficient exceeding $r > 0.30$. Reliability was tested using Cronbach's Alpha, with a threshold of ≥ 0.70 to indicate acceptable internal consistency. This higher benchmark enhances confidence in the robustness of the measurement tool. The streamlined and statistically grounded sampling and testing procedures strengthen the credibility of the findings and underscore the study's methodological contribution in applying a rigorous, context-sensitive approach to evaluating BRT performance through IPA in a tourism-oriented urban setting like Bali.

2.4 Data Analysis

Statistical tests were applied to determine significant differences in satisfaction levels and service performance metrics [17]. Qualitative insights from open-ended survey responses were thematically analyzed using coding techniques to identify recurring themes and unique perspectives. These insights complemented the quantitative findings, providing a holistic understanding of passenger satisfaction determinants [11]. Quantitative data were analyzed using descriptive statistics and Importance-Performance Analysis (IPA). The IPA framework assessed the relationship between passengers' perceptions of service performance and their expectations, identifying attributes requiring improvement or maintenance [7]. Mean scores were calculated for each service attribute, and gap analysis was performed to determine discrepancies between expectations and performance. Attributes were then plotted on a two-dimensional IPA matrix to prioritize improvement areas [18].

In measuring the level of satisfaction with service attributes, a 5-level Likert scale is used to measure the level of performance and level of interest (expectations) of BRT passengers. To measure the level of performance (implementation), five assessments are used with value scores, namely:

1. Strongly Agree (SA) is given a score of 5
2. Agree (A) is given a score of 4
3. Neutral (N) is given a score of 3
4. Disagree (DA) is given a score of 2
5. Strongly Disagree (SDA) is given a score of 1

To measure the level of importance (expectations) five assessments were used with scores:

1. Very Important (VI) is given a score of 5
2. Important (I) is given a score of 4
3. Quite Important (QI) is given a score of 3
4. Less Important (LI) is given a score of 2
5. Unimportant (UI) is given a score of 1

The suitability level is calculated using the following formula:

1. Suitability Level > 100%: Indicates that the current performance exceeds passenger expectations.
2. Suitability Level < 100% : Indicates a performance gap where the service does not meet passenger expectations and requires improvement.

2.5 Ethical Considerations

All participants were informed about the purpose of the study, and their consent was obtained prior to participation.

Anonymity and confidentiality were maintained throughout the data collection and analysis processes. Ethical approval for the study was obtained from relevant institutional review boards in Indonesia.

3. Results and Discussion

3.1 Test Research Instruments

Testing of the research questionnaire instrument is carried out before it is distributed to respondents and its validity and reliability will be tested so that the validity of the questionnaire can be confirmed by carrying out: (1) Validity Test with correlation analysis where each factor/question has a positive value and the calculated r value is greater than 0.30, and (2) Reliability Test with Cronbach's Alpha analysis. A reliable variable is determined if the alpha coefficient is greater than 0.60 (>0.60), and is said to be unreliable if the alpha coefficient is smaller than 0.60 (<0.60).

The table correlation for 30 respondents at the 0.05 significance level is 0.361. Based on the results of questionnaire data analysis on performance level assessment indicators is between 0.395 – 1,00, it shows that all realized correlation coefficient values are greater than the table correlation value (0.361) at a significance level of 0.05. Thus, all indicators are declared valid for use in data analysis. The results of the reliability test on the questionnaire results for each attribute of the performance level and expectations level assessment service were all declared reliable. This can be seen from the Cronbach's Alpha value which shows a value greater than the r-table (0.361).

3.2 Passenger Demographics and Travel Behavior

Type of Passenger Job shows the distribution of Bus Rapid Transit (BRT) passengers based on their occupational background. The results indicate that university students constitute the largest proportion of users, accounting for 26.79%, followed closely by private sector employees 25.00% and general students 24.11%. Meanwhile, civil servants represent 10.71% of passengers, business professionals make up 7.14%, and personnel from the military or police sectors form the smallest group at 6.25% of total respondents. The gender respondent's distribution was dominated by female 64.71% and male 35.29%. The average age of passengers was 16-30 years and 31-45 years, reflecting a predominantly young to middle-aged ridership. This distribution suggests that the BRT system primarily serves the younger and economically active population, particularly those engaged in education and private employment. Most passengers reported using the BRT systems for commuting to work or school (52.62%), while the remaining 47.38% used it for recreational or personal errands [19]. This bar chart on Figure 1. shows the distribution of working professionals, students, and Civil Servants among the BRT passengers in the Sarbagita area.

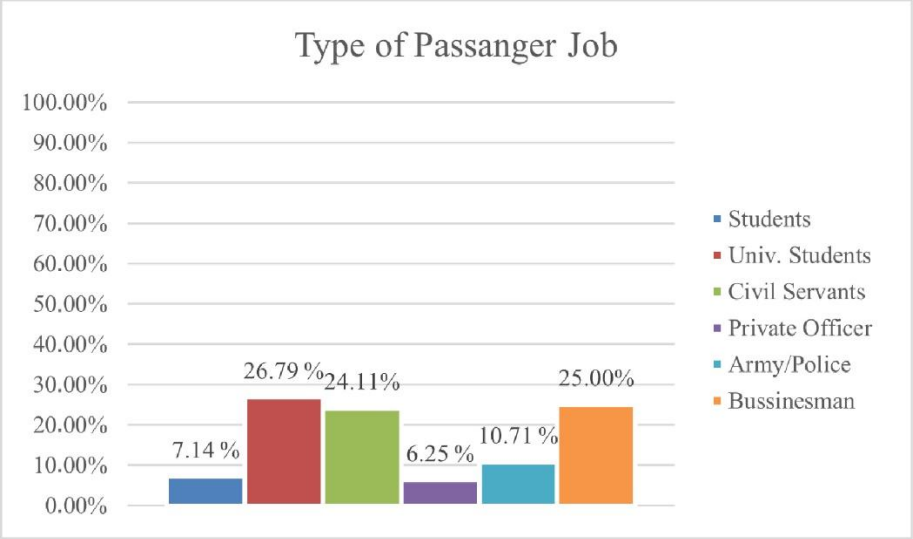

Figure 1. Type of Passenger Job

The frequency of BRT usage varied, with 64.71% of respondents indicating daily usage, while 20.59% used the service 6-7 times a week, and 14.71% were occasional users as shows on Figure 2. Notably, passengers who used the service daily expressed higher levels of satisfaction with the reliability and accessibility of the service compared to occasional users. This data shows that BRT has become a transportation option that is relied upon by the community, especially for those who have high mobility.

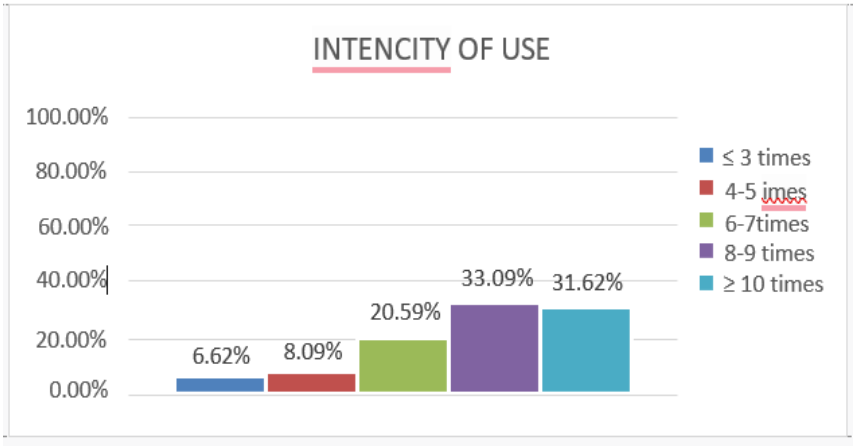

Figure 2. Intensity of Passenger Use

All BRT passengers have motorbikes in their families, with details of 50.41% owning one motorbike, 41.32% owning two motorbikes and 8.26% even owning three motorbikes. Furthermore, regarding car ownership data, it can be seen that the majority of passengers have private cars, with details of 74.36% owning one car, 24.36% owning two cars and even 1.28% owning t cars, as shows on Figure 3. This motorbike and car ownership data shows that the type of passenger is "Choice Passenger" meaning that the user has a choice of other modes of transportation, but with various considerations and awareness in terms of efficiency of time, energy, costs and also the environment chooses to use bus public transportation. BRT has also become an alternative mode of transportation that is popular with the public, especially people who own motorbikes. Users are not the "Captive Passenger" type, namely those who are completely dependent on public transportation.

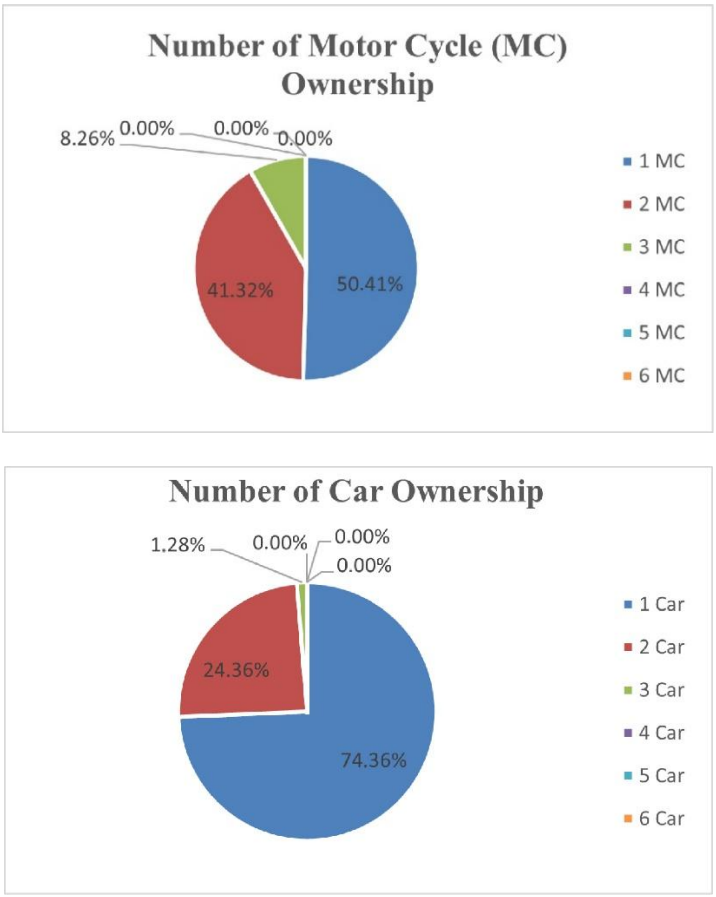

Figure 3. Number of Motor Cycle and Car Ownership

3.3 Performance Analysis

Analysis the performance level of existing BRT services in the Sarbagita area shows an assessment of the passenger satisfaction level with BRT performance indicators marked with score (Xi). This shows the objectivity of passengers in assessing the performance of the services provided by passengers. The complete results of the BRT performance attribute assessment can be seen in Table 1.

Table 1. Performance Level of BRT Services in Bali

Statements	Assessment of Performance VALUE					Performance level (Xi)
	SA	A	N	DA	SDA	
Route Characteristics						
1. Location and distance between one bus stop and another bus stop is good	44	53	32	6	1	541
2. Availability of portable bus stops (non-permanent) according to passenger needs	28	51	45	10	2	501
3. The bus stop road is accessible for people with disabilities	49	36	33	14	4	520
4. Determination of travel routes according to passenger needs	42	61	25	6	2	543
Service Characteristics						

5. The frequency of bus arrivals is not too long	32	53	38	11	2	510
6. Bus service operational hours are in accordance with passenger needs	37	66	27	5	1	541
Service Reliability						
7. The bus arrival schedule is on time	33	49	39	14	1	507
8. The bus departure schedule is on time	43	47	33	12	1	527
9. Arrival time between buses (time headway) is on time (according to information)	29	55	38	11	3	504
10. The bus passenger load capacity does not interfere with passenger comfort	78	53	5	0	0	617
Comfort						
11. The seating position on the bus is very comfortable	81	53	2	0	0	623
12. The quality of the air conditioning (AC) on the bus functions well	77	57	2	0	0	619
13. The noise and vibration levels of the bus do not disturb passengers	74	55	7	0	0	611
14. The seating at the bus stop is very comfortable	9	7	13	37	70	256
Cleanliness						
15. The room inside the bus is clean	79	54	3	0	0	620
16. First aid equipment on the bus is well available	75	55	5	1	0	612
17. The cleanliness of the bus body from the outside is well maintained	80	53	3	0	0	621
18. The waiting room at the bus stop is clean	6	5	23	35	67	256
Fare						
19. Bus ticket prices are in accordance with the services provided	55	80	1	0	0	598
Information						
20. Schedule and travel route information on the bus is clear (easy to understand)	48	81	7	0	0	585
21. Schedules and travel routes information at bus stops is clear (easy to understand)	14	40	46	32	4	436
22. Bus schedule and route information via telephone, mass media and internet access is clear (easy to understand)	39	84	12	1	0	569
Safety and Security						
23. The bus is suitable for use	64	70	2	0	0	606
24. The bus driver is traffic orderly when driving the bus	63	71	1	1	0	604

25. Glass breaking hammers for emergencies on the bus are well available	65	68	3	0	0	606
26. The company guarantees passenger safety from criminal acts while traveling on the bus	62	71	3	0	0	603
27. The company guarantees passenger safety from criminal acts while at the bus stop	30	29	15	41	21	414
Personnel						
28. The officers look neat	67	68	1	0	0	610
29. The officers provide politely service	64	70	2	0	0	606
30. The officers provide friendly service	64	71	1	0	0	607
31. The officers provide very clear service information during the trip	63	70	2	1	0	603
Costumer Service						
32. The bus ticket payment system is clear (easy to understand)	68	67	1	0	0	611
33. Customer complaint facilities (criticism and suggestions) are well available	62	68	5	1	0	599
34. The company quickly handles passenger complaints regarding the services provided	25	61	45	4	1	513
35. The company is quick to respond to problems that arise during the trip	22	60	50	4	0	508
Environment						
36. The buses used do not cause air pollution	15	9	38	30	44	329

Strongly Agree (SA), Agree (A), Neutral (N), Disagree (DA), Strongly Dissagree (SDA)

The performance assessment points to three standout strengths of Bali's BRT. On-board seating earns the highest rating (Score: 623), with passengers praising the layout and ergonomics that make rides notably comfortable. Exterior cleanliness follows closely (Score: 621), signaling disciplined fleet maintenance that keeps buses visually appealing and reinforces confidence in the system. Meanwhile, air-conditioning quality performs strongly (Score: 619); in Bali's tropical climate, reliable cooling is essential, and users report that the AC consistently meets expectations.

In contrast, the lowest-rated attributes reveal clear priorities for improvement. Waiting-room cleanliness at bus stops receives the weakest score (Score: 256), suggesting gaps in routine upkeep, litter control, and waste handling. Equally low, bus-stop seating comfort (Score: 256) indicates that benches are insufficient, worn, or poorly designed an issue that disproportionately affects riders during peak times and hot weather. Finally, concerns that buses still contribute to air pollution (Score: 329) highlight a perceived environmental shortfall. Together, these results suggest a targeted action plan: elevate stop-area hygiene and seating quality through stricter maintenance cycles and better furniture standards, and accelerate green-fleet measures (e.g., cleaner fuels or electrification) to address emissions and align system performance with sustainability expectations [20].

3.4 Importance and Expectation Analysis

Understanding the expectations and importance levels of BRT services from the perspective of passengers is essential for improving service quality and increasing user satisfaction. Descriptive analysis helps to

identify key areas where passenger expectations are high and where improvements are needed to meet these expectations effectively. This section presents an evaluation of passenger expectations based on various service attributes of BRT in Bali, focusing on the aspects that are considered most important by users, can be seen on Table 2.

The assessment of user expectations highlights five attributes that matter most to Bali's BRT riders. First, passengers place strong importance on the placement and spacing of bus stops (Score: 629): well-distributed, strategically located stops shorten walking distances, improve access, and stimulate ridership. Accessibility for people with disabilities follows closely (Score: 625); users expect ramps, tactile paving, and clear signage so that individuals with mobility and sensory needs can reach and use the system safely and independently.

Operational reliability rounds out the remaining priorities. On-time departures (Score: 624) are essential for commuters who plan their days around fixed schedules; delays erode convenience and trust. Equally, predictable headways (Score: 623) minimize waiting times and prevent crowding at stops, reinforcing a sense of dependability. Finally, routes aligned to passenger needs (Score: 622) ensure efficient travel, better connectivity, and shorter end-to-end journeys. Together, these priorities underscore a user mandate for a BRT network that is physically accessible, spatially well-planned, and operationally reliable.

Table 2. Level of Importance and Expectations of BRT Services in Bali

Statements	Assessment of Expectations					
	Assessment of Expectations					Expectations Level
	VI	I	QI	LI	NI	
Route Characteristics						
1. Location and distance between one bus stop and another bus stop is good	88	46	1	1	0	629
2. Availability of portable bus stops (non-permanent) according to passenger needs	87	42	5	2	0	622
3. The bus stop road is accessible for people with disabilities	87	45	2	2	0	625
4. Determination of travel routes according to passenger needs	84	48	2	2	0	622
Service Characteristics						
5. The frequency of bus arrivals is not too long	79	53	3	1	0	618
6. Bus service operational hours are in accordance with passenger needs	80	52	3	1	0	619
Service Reliability						
7. The bus arrival schedule is on time	86	43	6	1	0	622
8. The bus departure schedule is on time	85	47	3	1	0	624
9. Arrival time between buses (time headway) is on time (according to information)	84	48	3	1	0	623
10. The bus passenger load capacity does not interfere with passenger comfort	53	66	15	2	0	578
Comfort						
11. The seating position on the bus is very comfortable	70	53	11	2	0	599
12. The quality of the air conditioning (AC) on the bus functions well	66	60	9	1	0	599
13. The noise and vibration levels of the bus do not disturb passengers	57	60	15	3	1	577
14. The seating at the bus stop is very comfortable	58	60	13	5	0	579

Cleanliness						
15. The room inside the bus is clean	83	44	5	4	0	614
16. First aid equipment on the bus is well available	69	52	12	3	0	595
17. The cleanliness of the bus body from the outside is well maintained	61	56	16	3	0	583
18. The waiting room at the bus stop is clean	62	55	14	5	0	582
Fare						
19. Bus ticket prices are in accordance with the services provided	72	59	5	0	0	611
Information						
20. Schedule and travel route information on the bus is clear (easy to understand)	77	51	8	0	0	613
21. Schedules and travel routes information at bus stops is clear (easy to understand)	76	58	2	0	0	618
22. Bus schedule and route information via telephone, mass media and internet access is clear (easy to understand)	72	60	4	0	0	612
Safety and Security						
23. The bus is suitable for use	84	42	9	1	0	617
24. The bus driver is traffic orderly when driving the bus	82	44	9	1	0	615
25. Glass breaking hammers for emergencies on the bus are well available	57	64	14	0	1	584
26. The company guarantees passenger safety from criminal acts while traveling on the bus	71	50	13	1	1	597
27. The company guarantees passenger safety from criminal acts while at the bus stop	68	53	13	1	1	594
Personnel						
28. The officers look neat	59	63	10	3	1	584
29. The officers provide politely service	68	58	7	2	1	598
30. The officers provide friendly service	69	58	7	1	1	601
31. The officers provide very clear service information during the trip	63	62	8	2	1	592
Costumer Service						
32. The bus ticket payment system is clear (easy to understand)	69	58	5	2	2	598
33. Customer complaint facilities (criticism and suggestions) are well available	63	59	10	2	2	587
34. The company quickly handles passenger complaints regarding the services provided	60	65	8	2	1	589
35. The company is quick to respond to problems that arise during the trip	62	63	9	0	2	591
Environment						
36. The buses used do not cause air pollution	55	62	15	1	3	573

3.5 Importance-Performance Analysis and Priority Determination

Importance-Performance Analysis (IPA) is used to identify gaps between passenger expectations (importance) and actual service performance of BRT in Bali. By comparing the existing service

performance scores with passenger expectations, IPA provides insights into the areas that need improvement to enhance passenger satisfaction.

The suitability level is a key metric in this analysis, calculated as the ratio of performance scores to importance scores from the passenger's perspective. The suitability level determines the priority order for service improvements by highlighting factors that significantly impact BRT passenger satisfaction. Performance indicators with high suitability level if the comparison of the bus performance and passenger expectation more than 100%, it shows at Table 3**, i**ndicates that the current performance exceeds passenger expectations.

Table 3. Performance Indicators with High Suitability Level (Existing Performance Exceeding Expectations)

Statements	Suitability Level		
	Performance (Xi)	Expectations (Y)i	Comparison
Service Reliability			
1. The bus passenger load capacity does not interfere with passenger comfort	617	578	106.75%
Comfort			
2. The seating position on the bus is very comfortable	623	599	104.01%
3. The quality of the air conditioning (AC) on the bus functions well	619	599	103.34%
4. The noise and vibration levels of the bus do not disturb passengers	611	577	105.89%
Cleanliness			
5. The room inside the bus is clean	620	614	100.98%
6. First aid equipment on the bus is well available	612	595	102.86%
7. The cleanliness of the bus body from the outside is well maintained	621	583	106.52%
Safety and Security			
8. Glass breaking hammers for emergencies on the bus are well available	606	584	103.77%
9. The company guarantees passenger safety from criminal acts while traveling on the bus	603	597	101.01%
Personnel			
10. The officers look neat	610	584	104.45%
11. The officers provide politely service	606	598	101.34%
12. The officers provide friendly service	607	601	101.00%
13. The officers provide very clear service information during the trip	603	592	101.86%
Costumer Service			
14. The bus ticket payment system is clear (easy to understand)	611	598	102.17%

15.	Customer complaint facilities (criticism and suggestions) are well available	599	587	102.04%

The indicators with high suitability levels (>100%) reflect service attributes where the existing performance exceeds passenger expectations**.** These attributes indicate strengths in the BRT system that should be maintained to ensure continued user satisfaction.

The key findings indicate strong performance in comfort and operations across the BRT service. Passenger load capacity management is rated very highly (106.75%), with riders perceiving crowding as well controlled evidence that the system effectively prevents overloading, a common weakness in public transport [19]. On-board seating comfort exceeds expectations (104.01%), suggesting that ergonomic design and material quality are enhancing the user experience. Air-conditioning quality is consistently reliable (103.34%), a critical factor in Bali's tropical climate [21]. Likewise, noise and vibration levels are well managed (105.89%), delivering a smooth ride that boosts overall travel satisfaction [12].

Cleanliness standards are also impressive: interior and exterior cleanliness score 106.52% and 100.98%, respectively, reflecting disciplined maintenance and sound operational management [22]. Personnel and customer service perform above expectations (above 101%) in terms of appearance, politeness, and friendliness, signalling strong service culture [6]. Finally, safety features, including the presence of a glass-breaking hammer (103.77%), are recognized by passengers, demonstrating a proactive approach to emergency preparedness. Collectively, these results show that effective capacity control, physical comfort, environmental conditioning, cleanliness, professional staffing, and visible safety provisions form a solid foundation for reliability and public trust in the BRT system.

Indicators with low suitability levels (<100%) as shows on Table 4, highlight service attributes where existing performance does not meet passenger expectations**,** indicating gaps that require improvement. Overall, the evaluation of the BRT service reveals several fundamental issues that reduce passenger satisfaction and may discourage the public from using public transportation. Bus stop comfort and cleanliness scored the lowest (43.99%–44.21%), as poorly maintained waiting areas and uncomfortable seating negatively affect the waiting experience. Air pollution concerns remain significant (57.42%), indicating the need for cleaner, more environmentally friendly fleet operations. The clarity of information at bus stops also presents a problem (70.55%); unclear route and schedule information leads to passenger confusion and frustration [23]. In terms of punctuality, the performance of headway, arrival frequency, and departure schedules was rated below expectations (80.55%–87.40%). Such unreliability undermines public trust in the system, consistent with Hensher and Golob's (2008) findings on the relationship between reliability and mode choice. Accessibility for people with disabilities remains a major concern (83.20%), highlighting the need for better infrastructure to support inclusivity (Transportation, 2022). Lastly, security at bus stops (69.70%) continues to be an issue, as fears of potential criminal activity persist indicating a need for enhanced safety measures such as open-space design, adequate lighting, visible security personnel, and CCTV surveillance [24].

These findings collectively emphasize the importance of an integrated improvement strategy one that combines infrastructure upgrades, clearer passenger information, operational reliability, inclusivity, and enhanced security to improve the overall quality and trustworthiness of the BRT system [25].

Table 4. Performance Indicators with Low Suitability Level (Existing Performance Below Expectations)

	Statements	Suitability Level		
		Performance (Xi)	Expectations (Yi)	Comparisons (Xi/Yi.100%)
	Route Characteristics			
1.	Location and distance between one bus stop and another bus stop is good	541	629	86.01%

2.	Availability of portable bus stops (non-permanent) according to passenger needs	501	622	80.55%
3.	The bus stop road is accessible for people with disabilities	520	625	83.20%
4.	Determination of travel routes according to passenger needs	543	622	87.30%
	Service Characteristics			
5.	The frequency of bus arrivals is not too long	510	618	82.52%
6.	Bus service operational hours are in accordance with passenger needs	541	619	87.40%
	Service Reliability			
7.	The bus arrival schedule is on time	507	622	81.51%
8.	The bus departure schedule is on time	527	624	84.46%
9.	Arrival time between buses (time headway) is on time (according to information)	504	623	80.90%
	Comfort			
10.	The seating at the bus stop is very comfortable	256	579	44.21%
	Cleanliness			
11.	The waiting room at the bus stop is clean	256	582	43.99%
	Fare			
12.	Bus ticket prices are in accordance with the services provided	598	611	97.87%
	Information			
13.	Schedule and travel route information on the bus is clear (easy to understand)	585	613	95.43%
14.	Schedules and travel routes information at bus stops is clear (easy to understand)	436	618	70.55%
15.	Bus schedule and route information via telephone, mass media and internet access is clear (easy to understand)	569	612	92.97%
	Safety and Security			
16.	The bus is suitable for use	606	617	98.22%
17.	The bus driver is traffic orderly when driving the bus	604	615	98.21%
18.	The company guarantees passenger safety from criminal acts while at the bus stop	414	594	69.70%
	Costumer Service			
19.	The company quickly handles passenger complaints regarding the services provided	513	589	87.10%
20.	The company is quick to respond to problems that arise during the trip	508	591	85.96%
	Environment			

21.	The buses used do not cause air pollution	329	573	57.42%

The Importance-Performance Analysis (IPA) and suitability level assessment of the Bali BRT system reveal a nuanced picture of its service performance, highlighting both operational strengths and critical shortcomings. Several key indicators—such as passenger load capacity management, seating comfort, air conditioning quality, and cleanliness of bus interiors and exteriors—show high suitability levels, reflecting strong alignment with passenger expectations. These findings are consistent with IPA studies in Bogotá's TransMilenio and Jakarta's TransJakarta, where interior comfort and vehicle cleanliness were also identified as major contributors to passenger satisfaction (Hidalgo & Carrigan, 2010; Susilo et al., 2021) [21]. Transit passengers' behavioural intentions: the influence of service quality and customer satisfaction Bali, the consistently maintained cleanliness and ergonomic seating design foster positive user perceptions, while the reliable air conditioning system significantly enhances comfort in a tropical tourism-driven context, where passenger expectations for convenience are particularly high. Additionally, the professionalism and courteousness of BRT personnel reinforce user trust, mirroring findings from studies in Guangzhou and Curitiba, where staff behavior directly influenced perceived service quality and willingness to reuse public transport [12].

Further, punctuality and headway reliability remain problematic. This challenge parallels findings from Jakarta, Manila, and Nairobi, where traffic congestion and signal delays undermine schedule adherence [18]. Bali's tourism-related traffic congestion exacerbates this issue, emphasizing the need for dedicated lanes, adaptive signal control, and real-time tracking systems to ensure operational reliability. Equally critical is accessibility for passengers with disabilities, where Bali lags behind global standards. Unlike the BRT systems in Mexico City and Seoul, which feature tactile paving, boarding bridges, and auditory announcements, Bali's infrastructure often lacks such inclusive features, limiting mobility equity [22].

Lastly, safety and security at bus stops require urgent attention. Reports of petty crimes and inadequate lighting have eroded passenger confidence. Comparative evidence from Singapore's and Brisbane's BRT networks demonstrates that well-designed stops with surveillance systems, emergency intercoms, and visible security personnel significantly improve perceived safety [23]. Therefore, enhancing safety infrastructure alongside service reliability and environmental sustainability represents a holistic pathway for improvement. In summary, while the Bali BRT system performs well in operational comfort and service interaction, it underperforms in infrastructure quality, environmental sustainability, and accessibility compared to leading global BRT systems. These findings underscore the importance of adopting a technically integrated and context-sensitive improvement strategy, combining IPA insights with engineering interventions to elevate BRT performance and achieve a more sustainable, inclusive urban transport model for Bali [8].

To address these challenges, several recommendations can be proposed. First, the improvement of bus stop facilities is essential, particularly in enhancing seating comfort, cleanliness, and overall maintenance. Regular inspections and scheduled cleaning routines should be implemented to improve the passenger experience. Second, accessibility features need to be upgraded to accommodate individuals with disabilities, making the transport system more inclusive. Third, optimizing scheduling and headway management through real-time tracking and dynamic scheduling technologies could help reduce delays and improve punctuality. Fourth, transitioning to more environmentally friendly transport options, such as electric buses, would mitigate air pollution concerns and align with sustainable urban mobility strategies. Lastly, improving passenger information systems through better digital integration, as well as strengthening security at bus stops with increased lighting and surveillance, would further enhance user confidence in the BRT system [2].

By focusing on these improvements while maintaining the strengths that have contributed to positive user experiences, the BRT system in Bali can become a more efficient, accessible, and sustainable urban transit solution. Addressing the areas of weakness will not only improve passenger satisfaction but also encourage higher ridership and promote a shift towards public transportation as a primary mode of urban mobility. Continued monitoring and adaptation based on passenger feedback and emerging best practices in public transport will be crucial in ensuring the long-term success of BRT services in Bali [23].

4. Conclusion

This study finds that Bali's BRT (Trans Metro Dewata and Trans Sarbagita) exceeds passenger expectations in seating comfort, air-conditioning, cleanliness, and staff professionalism, yet faces systemic and infrastructural gaps that demand technical—not merely service-level—solutions. Importance–Performance Analysis (IPA) points to an integrated engineering–policy approach linking user experience with reliability, sustainability, and inclusivity. Priorities include redesigning stops and accessibility features and deploying smart information systems—real-time passenger updates, digital signage, mobile trip planners—integrated with ITS, alongside smart scheduling and adaptive headway control to improve punctuality. Upgrading universal access (ramps, tactile paving, low-floor platforms) should align with international inclusive design standards. Environmentally, perceived diesel emissions underscore the urgency of electrifying or hybridizing fleets in line with Indonesia's decarbonization roadmap, supported by renewable-powered depots and energy-efficient traffic management. Embedding real-time monitoring, fleet electrification, and data-driven scheduling into future policy can shift Bali's BRT from patching dissatisfaction to building a resilient, intelligent, low-emission transit ecosystem.

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