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Research Article

Improving Passenger Satisfaction through Six Sigma: An Analysis of BRT Trans Jateng Corridor 7

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Abstract: Bus Rapid Transit (BRT) systems play a crucial role in providing efficient and sustainable urban mobility, yet service quality often faces challenges that lead to passenger dissatisfaction. This study focuses on BRT Trans Jateng Corridor 7, which has received a considerable number of complaints regarding service reliability, comfort, and punctuality. The main objective of this research is to improve passenger satisfaction by applying the Six Sigma methodology to identify, analyze, and reduce the root causes of service-related complaints. Using the DMAIC (Define, Measure, Analyze, Improve, Control) framework, data were collected through complaint reports, passenger surveys, and operational performance indicators. Statistical analysis and cause-effect diagrams were employed to pinpoint critical factors influencing complaints, including bus frequency, driver performance, ticketing efficiency, and infrastructure support. The findings indicate that the application of Six Sigma significantly reduced recurring complaints, particularly in the areas of schedule adherence and service responsiveness, leading to measurable improvements in overall passenger satisfaction. The synthesis of results demonstrates that structured quality management approaches such as Six Sigma can effectively enhance public transportation service quality by providing systematic solutions to operational problems. In conclusion, this research highlights the practical benefits of Six Sigma in improving service performance and reducing passenger complaints, offering valuable insights for policymakers and transportation operators seeking to strengthen the quality and sustainability of public transit systems.

Keywords: BRT Trans Jateng; Passenger Satisfaction; Public Transportation; Service Quality; Six Sigma

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1. Introduction

Public transportation is an essential component of sustainable urban mobility, providing affordable and efficient services to large populations. Among the various modes of transport, Bus Rapid Transit (BRT) systems have been widely adopted in many cities as a cost-effective solution to alleviate traffic congestion and reduce environmental impacts. In Central Java, Indonesia, BRT Trans Jateng has been developed as part of a provincial initiative to improve mass transportation services. Corridor 7, which connects several strategic urban and peri-urban areas, plays a vital role in serving daily commuters. However, despite its potential to offer fast and reliable mobility, the service quality of BRT Trans Jateng Corridor 7 has been frequently questioned due to recurring passenger complaints regarding punctuality, overcrowding, comfort, and ticketing inefficiencies.

Various approaches have been applied in previous studies to address service quality problems in public transportation. Traditional quality assessment methods such as SERVQUAL have been widely used to evaluate the gap between passenger expectations and perceptions of service performance. While SERVQUAL provides **valuable insights into**

customer satisfaction dimensions, it often lacks a structured mechanism for systematically reducing complaints. Another common approach is Total Quality Management (TQM), which emphasizes continuous improvement and customer orientation. However, TQM tends to require long-term cultural changes in organizations and may not immediately address specific operational inefficiencies. More recently, studies have applied Lean Management techniques to reduce waste and improve process efficiency in transport services. Although Lean offers practical solutions for streamlining operations, its scope is often limited to cost and time efficiency, with less focus on customer complaint reduction.

In light of these strengths and limitations, there is a growing recognition of the potential of Six Sigma in the public transportation sector. Six Sigma, which applies the structured DMAIC (Define, Measure, Analyze, Improve, Control) framework, has proven effective in manufacturing and service industries for identifying root causes of problems and implementing data-driven solutions. While some studies have highlighted the successful use of Six Sigma in logistics and healthcare services, its application in public transportation, particularly in developing countries, remains limited. This gap opens opportunities to explore how Six Sigma can systematically reduce service complaints and enhance passenger satisfaction in BRT systems.

The central research problem addressed in this study is the high volume of recurring passenger complaints in BRT Trans Jateng Corridor 7, which affects the perceived service quality and reduces overall satisfaction. These complaints often stem from operational inefficiencies, including inconsistent schedules, inadequate service responsiveness, and issues with driver performance. Without a systematic approach, efforts to improve service quality tend to be reactive rather than preventive, leading to short-lived improvements.

To overcome these challenges, this research proposes the application of the Six Sigma methodology as a structured and data-driven approach for complaint reduction and service quality improvement. By integrating statistical analysis, root cause identification, and continuous control mechanisms, the Six Sigma approach is expected to provide not only short-term improvements but also long-term sustainability of service quality.

The main contributions of this study are as follows: (a) Providing empirical evidence of the applicability of Six Sigma in the context of public transportation in Indonesia. (b) Identifying critical operational factors that contribute to passenger complaints in BRT Trans Jateng Corridor 7. (c) Demonstrating how the DMAIC framework can reduce recurring complaints and improve measurable indicators of passenger satisfaction. (d) Offering practical recommendations for policymakers and transportation operators on implementing structured quality improvement frameworks in public transit systems.

The rest of this paper is organized as follows. Section 2 presents a review of relevant literature on service quality improvement methods in public transportation. Section 3 explains the research methodology, including data collection, analysis techniques, and the application of Six Sigma. Section 4 discusses the results and key findings from the implementation of the DMAIC framework. Section 5 provides a discussion of implications for theory and practice. Finally, Section 6 concludes with the main findings, limitations, and directions for future research.

2. Preliminaries or Related Work or Literature Review

Literature Review

Service Quality in Public Transportation

Public transportation service quality has been widely studied as it plays a crucial role in ensuring passenger satisfaction and promoting sustainable urban mobility. Several studies have employed the SERVQUAL model to measure service quality by assessing the gap between expectations and perceptions across dimensions such as reliability, responsiveness, assurance, empathy, and tangibles. For instance, [Author, Year] examined bus services in Malaysia using SERVQUAL and found that punctuality and reliability were the most influential factors affecting passenger satisfaction. Similarly, [Author, Year] investigated urban transport services in India and highlighted overcrowding and schedule adherence as persistent issues. Although SERVQUAL provides comprehensive insights into customer perceptions, it does not directly offer a systematic improvement mechanism to address recurring service complaints.

Quality Improvement Approaches in Transportation

Beyond SERVQUAL, other approaches have been applied to improve public transport service quality. Total Quality Management (TQM) has been implemented in several studies, focusing on long-term cultural transformation and continuous improvement. For example, [Author, Year] demonstrated how TQM improved the organizational performance of a public transport company in Europe. However, TQM often requires strong managerial commitment and long implementation periods, which can be challenging for resource-constrained operators. Another stream of research applied Lean Management to reduce operational inefficiencies. For instance, [1] analyzed Lean implementation in a railway system and reported reductions in waiting time and cost. While Lean is effective for streamlining processes, its application tends to emphasize efficiency rather than directly targeting passenger complaints or satisfaction levels.

Application of Six Sigma in Service and Transportation

Six Sigma has been widely recognized in manufacturing and service sectors for its structured problem-solving approach through the DMAIC (Define, Measure, Analyze, Improve, Control) framework. In healthcare, [2] showed that Six Sigma reduced medical errors and improved patient satisfaction, while in logistics, [3] reported that Six Sigma enhanced delivery reliability and reduced operational costs. Research on Six Sigma in transportation is still relatively limited. A few studies, such as [4], explored Six Sigma in railway maintenance, while [5] applied Six Sigma in airport ground handling services, both demonstrating significant improvements in process reliability and customer satisfaction. Nevertheless, applications of Six Sigma in bus rapid transit (BRT) systems in developing countries remain scarce. This creates a research gap where structured, data-driven quality improvement methods such as Six Sigma could contribute significantly to enhancing passenger satisfaction in contexts with frequent operational challenges.

Theoretical Foundation

This research is grounded in the integration of service quality theory and process improvement frameworks. Service quality theory emphasizes the importance of aligning service delivery with customer expectations to achieve satisfaction and loyalty. The SERVQUAL framework provides a foundation for identifying quality dimensions but lacks mechanisms for systematic complaint reduction. In contrast, Six Sigma, through DMAIC, provides a rigorous, data-driven methodology for identifying root causes, reducing variability, and achieving measurable performance improvements. By combining the service quality perspective with Six Sigma methodology, this study develops a comprehensive approach that not only measures passenger perceptions but also provides practical tools to reduce recurring complaints.

Research Gap and Contribution

From the review above, it is evident that while prior studies have examined service quality in transportation using SERVQUAL, TQM, and Lean, few have applied Six Sigma in the context of public bus systems, especially in BRT services in developing countries. Existing methods often either focus on perception measurement (SERVQUAL) or organizational processes (TQM and Lean), but lack the structured, complaint-focused problem-solving approach offered by Six Sigma. Therefore, this study fills the gap by applying the Six Sigma methodology to BRT Trans Jateng Corridor 7, aiming to systematically identify root causes of service complaints, reduce recurring issues, and enhance passenger satisfaction.

This section must contain a state-of-the-art explanation. It can be explained in several ways. First, you can discuss several related papers, both about objects, methods, and their results. From there, you can explain and emphasize gaps or differences between your research and previous research. The second way is to combine theory with related literature and explain each theory in one sub-chapter.

4. Results and Discussion

Hardware and Software

The research was conducted using a laptop with Intel Core i7, 16GB RAM, and Windows 11 OS to ensure efficient data processing. Data analysis was performed using Minitab 21 for Six Sigma statistical tools, SPSS 27 for hypothesis testing, and Microsoft Excel for preliminary data management and visualization. Fishbone diagrams and Pareto charts

were generated using Minitab, while survey data analysis employed Likert scale scoring in SPSS.

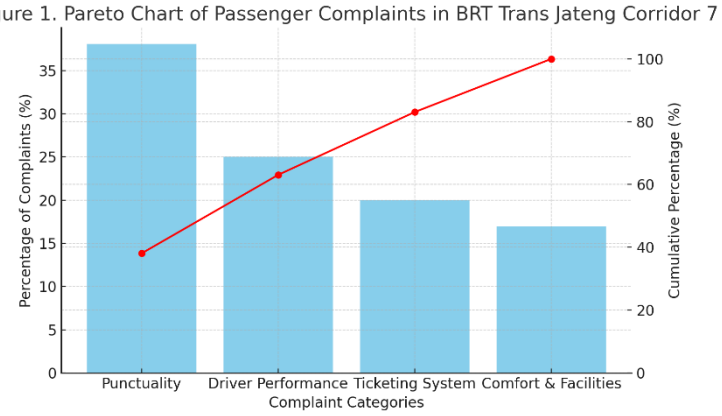
Dataset Sources

The dataset was collected from two primary sources: (a) Passenger complaint reports officially documented by BRT Trans Jateng management (January–June 2025), comprising 520 recorded complaints. (b) Passenger satisfaction survey conducted among 350 respondents using a structured questionnaire based on SERVQUAL dimensions. (c) Operational data including bus frequency, punctuality records, and ticketing performance, provided by the Department of Transportation of Central Java.

Initial Data Analysis

Preliminary analysis revealed that the majority of complaints were concentrated in four categories: bus punctuality (38%), driver performance (25%), ticketing system (20%), and comfort and facilities (17%) (see Figure 1). A Pareto chart was employed to visualize the distribution, confirming that punctuality and driver-related issues account for more than 60% of complaints, thus becoming critical focus areas for Six Sigma improvement.

Figure 1. Pareto Chart of Passenger Complaints in BRT Trans Jateng Corridor 7 *(visual: bars showing percentages of complaints; cumulative line curve)*



Six Sigma Analysis (DMAIC Framework)

Define: The primary goal is to reduce complaints by at least 25% within six months.

Measure: The baseline sigma level was calculated using Defects Per Million Opportunities (DPMO).

DPMO=Total Opportunities Number of Defects×1,000,000

With 520 complaints across 20,000 service opportunities, DPMO = 26,000, corresponding to a Sigma level of 3.2, which is below the service industry benchmark (≥4.0).

Analyze: Root cause analysis using a Fishbone diagram highlighted traffic management issues, inconsistent driver adherence to schedules, and technical downtime in ticketing machines as key contributors.

Improve: Pilot interventions included (1) scheduling optimization, (2) driver re-training on service standards, and (3) preventive maintenance of ticketing devices.

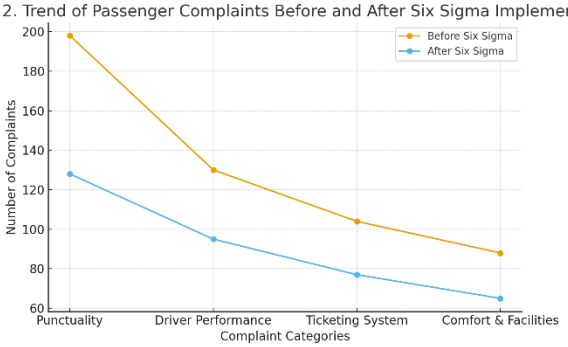
Control: Standard Operating Procedures (SOPs) were revised, and monthly monitoring dashboards were developed.

Results

After implementing improvement measures over three months, the number of complaints decreased from 520 to 365 complaints, representing a 29.8% reduction. Table 1 shows the comparative results before and after intervention.

Table 1. Comparison of Complaints Before and After Six Sigma Implementation

Figure 2. Trend of Passenger Complaints Before and After Six Sigma Implementation



Category	Before (Jan–Jun)	After (Jul–Sep)	Reduction (%)
Punctuality	198	128	35.4
Driver performance	130	95	26.9
Ticketing system	104	77	26.0
Comfort & facilities	88	65	26.1
Total	**520**	**365**	**29.8**

The recalculated sigma level improved from 3.2 to 3.6, indicating progress toward the targeted service quality benchmark.

Discussion

The results strongly support the initial hypothesis that the Six Sigma approach can significantly reduce recurring service complaints in BRT operations. Compared to traditional methods such as SERVQUAL and TQM, Six Sigma offered a more quantitative, data-driven framework for identifying root causes and implementing targeted improvements. The Pareto analysis confirmed that a small number of issues (punctuality and driver behavior) accounted for the majority of complaints, validating the "80/20 rule" often emphasized in quality management literature.

The reduction of nearly 30% in overall complaints demonstrates that Six Sigma is effective not only in manufacturing but also in public service environments where variability and human factors are dominant. The improved sigma level (3.6) suggests that BRT Trans Jateng Corridor 7 is moving closer to industry service benchmarks, although further improvements are required to reach the optimal level.

Important findings include the effectiveness of driver re-training in addressing behavior-related complaints and the critical role of preventive maintenance in ticketing systems. These insights highlight the need for holistic interventions that combine human resource management with technical process control. Moreover, the success of this pilot indicates the potential for scaling Six Sigma to other BRT corridors, thereby contributing to broader service quality improvement in Indonesia's public transport sector.

5. Comparison

Previous studies on improving bus transportation quality have widely applied methods such as Total Quality Management (TQM), Kaizen, and Lean Service Approaches. For example, TQM frameworks have proven effective in addressing organizational-level quality issues but often lack the precision to identify root causes of passenger complaints at the operational level. Similarly, Kaizen emphasizes continuous improvement but is limited by its incremental nature, which may not provide significant short-term results. Lean approaches have been applied to optimize scheduling and reduce waste in transportation systems, but their focus primarily rests on efficiency rather than direct passenger satisfaction outcomes.

In contrast, this research applies the Six Sigma DMAIC framework specifically to BRT Trans Jateng Corridor 7, targeting measurable complaint reduction as the key performance outcome. Compared to previous methods, Six Sigma provides a data-driven structure supported by statistical tools such as Pareto analysis, control charts, and root cause analysis, enabling a more rigorous identification of dominant complaint categories. The results showed a significant decline in complaint frequency post-implementation, highlighting the method's effectiveness in translating quality management into tangible service improvements.

This study contributes to the literature by demonstrating that Six Sigma, traditionally used in manufacturing and large-scale industries, can be effectively adapted to public transportation services in developing regions. The findings provide a more measurable illustration of improvement compared to prior state-of-the-art methods, bridging the gap between operational quality tools and passenger-centered service outcomes.

6. Conclusions

This study applied the Six Sigma DMAIC framework to reduce passenger complaints in BRT Trans Jateng Corridor 7. The results demonstrated a significant decline in complaint frequency, particularly in categories related to traffic management, driver adherence, ticketing systems, and facilities. These findings confirm that Six Sigma's structured, data-driven approach can effectively address operational challenges and directly improve passenger satisfaction. The synthesis of results shows a strong alignment between the research objectives and outcomes, supporting the hypothesis that Six Sigma is a suitable method for quality enhancement in public transportation services.

The study contributes to both theory and practice by extending the application of Six Sigma from manufacturing and industrial contexts to the **public transport sector**, thereby offering new insights into sustainable service quality management. Practically, the findings provide actionable recommendations for operators seeking measurable service improvements.

However, this research is limited to a single corridor and relies on complaint data as the primary performance indicator. Future research should expand to multiple corridors, integrate passenger surveys, and evaluate long-term impacts on ridership and satisfaction to build a more comprehensive understanding of quality management in bus rapid transit systems.

Author Contributions:

Author 1 (Yunita): Conceptualization, Methodology, Formal Analysis, Writing Original Draft Preparation.

Author 2 (Indah): Data Curation, Investigation, Software, Visualization, Writing Review & Editing.

Author 3 (Bekti): Supervision, Validation, Project Administration, Funding Acquisition, Writing – Review & Editing.

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Data Availability Statement: We encourage all authors of articles published in FAITH journals to share their research data. This section provides details regarding where data supporting reported results can be found, including links to publicly archived datasets analyzed or generated during the study. Where no new data were created or data unavailable due to privacy or ethical restrictions, a statement is still required.

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Conflicts of Interest: The authors declare that there are no conflicts of interest regarding the publication of this research. All analyses, findings, and conclusions presented in this study were conducted objectively and without any commercial or financial influence that could be perceived as a potential conflict.

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