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EVALUATION OF PERFORMANCE MEASURES ADOPTED BY URBAN TRANSPORT COMPANIES IN THE CITY OF MANAUS, BRAZIL

AVALIAÇÃO DAS MEDIDAS DE DESEMPENHO ADOTADAS POR EMPRESAS DE TRANSPORTE URBANO DA CIDADE DE MANAUS, BRASIL

EVALUACIÓN DE LAS MEDIDAS DE DESEMPEÑO ADOPTADAS POR LAS EMPRESAS DE TRANSPORTE URBANO EN LA CIUDAD DE MANAUS, BRASIL

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Abstract

Urban mobility and logistics management have been a constant challenge for science and public management, mainly because they lack performance measures to improve the efficiency, sustainability, and quality of public transport. A major existing scientific gap is the scarcity of empirical research on how professionals in the sector effectively use such indicators, particularly their advantages, limitations, and risks. In this sense, this study aimed to analyze the performance measures adopted in urban transport management, understanding their practical application and managerial implications. The method followed four stages: research planning, literature review, data collection through interviews with company representatives, and comparative analysis between empirical and theoretical evidence, in a qualitative, cross-sectional, and systemic approach. The results indicated the use of indicators such as travel time, fleet occupancy, punctuality, user satisfaction, and route reliability, applied through hybrid methods that combine manual records and digital technologies; Operational advantages were also identified, as well as limitations related to data collection failures in service execution and the influence of external factors, such as congestion and poor road conditions. The conclusion shows that the analyzed system aligns with the international literature, though it needs to improve its monitoring mechanisms. The main contribution

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Pages: 1-42

of the study to science lies in generating empirical evidence on the real-world application of these metrics, strengthening the field of logistics applied to urban mobility.
Keywords: Performance measures; Urban transport; Urban mobility; Regional development; Public management.

Resumo

A mobilidade urbana e a gestão logística têm sido um desafio constante para a ciência e para a gestão pública, principalmente porque carecem de indicadores de desempenho que permitam melhorar a eficiência, a sustentabilidade e a qualidade do transporte público. Uma grande lacuna científica é a escassez de pesquisas empíricas que investiguem como tais indicadores são efetivamente utilizados por profissionais do setor, especialmente considerando suas vantagens, limitações e riscos. Neste sentido, este estudo teve como objetivo analisar as medidas de desempenho adotadas na gestão do transporte urbano, abrangendo sua aplicação prática e suas implicações gerenciais. O método seguiu quatro etapas: planejamento da pesquisa, revisão da literatura, coleta de dados por meio de entrevistas com representantes de empresas e análise comparativa entre evidências empíricas e teóricas, em uma abordagem qualitativa, transversal e de nível sistêmico. Os resultados indicaram o uso de indicadores como tempo de viagem, ocupação da frota, pontualidade, satisfação do usuário e confiabilidade das rotas, aplicados por meio de métodos híbridos que combinam registros manuais e tecnologias digitais; também foram identificadas vantagens operacionais, limitações relacionadas a falhas na coleta de dados durante a execução dos serviços e influência de fatores externos, como congestionamentos e precariedade das vias. A conclusão mostra que o sistema analisado está alinhado à literatura internacional, embora necessite aprimorar seus mecanismos de monitoramento. A principal contribuição do estudo para a ciência reside na geração de evidências empíricas sobre a aplicação prática dessas métricas, fortalecendo o campo da logística aplicada à mobilidade urbana.
Palavras-chave: Medidas de desempenho; Transporte urbano; Mobilidade urbana; Desenvolvimento regional; Gestão pública.

Resumen

La movilidad urbana y la gestión logística han representado un desafío constante para la ciencia y la administración pública, principalmente debido a la falta de indicadores de desempeño que permitan mejorar la eficiencia, la sostenibilidad y la calidad del transporte público. Una importante brecha científica radica en la escasez de investigación empírica que analice la efectividad de estos indicadores por parte de los profesionales del sector, considerando especialmente sus ventajas, limitaciones y riesgos. En este sentido, este estudio tuvo como objetivo analizar los indicadores de desempeño aplicados a la gestión del transporte urbano, incluyendo su aplicación práctica y sus implicaciones gerenciales. El método se desarrolló en cuatro etapas: planificación de la investigación, revisión bibliográfica, recopilación de datos mediante entrevistas a representantes de empresas y análisis comparativo entre la evidencia empírica y la teórica, con un enfoque cualitativo, transversal y sistémico. Los resultados indicaron el uso de indicadores como el tiempo de viaje, la ocupación de la flota, la puntualidad, la satisfacción del usuario y la confiabilidad de la ruta, aplicados mediante métodos híbridos que combinan registros manuales y tecnologías digitales. Asimismo, se identificaron ventajas operativas y limitaciones relacionadas con fallas en la recopilación de datos durante la ejecución del servicio, así como con la influencia de factores externos, como la congestión y el mal estado de las carreteras. La conclusión muestra que el sistema analizado se ajusta a la literatura internacional, si bien requiere mejoras en sus mecanismos de monitoreo. La principal contribución del estudio a la ciencia radica en la generación de evidencia

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empírica sobre la aplicación práctica de estas métricas, lo que fortalece el campo de la logística aplicada a la movilidad urbana.
Palabras clave: Medidas de desempeño; Transporte urbano; Movilidad urbana; Desarrollo regional; Gestión pública.

1. Introduction

The rapid growth of cities and the intensification of urban mobility have significantly increased the need for public transportation systems that offer efficient, sustainable, and comfortable services to the population. In increasingly dense and complex urban contexts, public transportation plays a fundamental role in promoting accessibility, reducing congestion, and mitigating the environmental impacts associated with the intensive use of individual vehicles. In this scenario, researchers have highlighted that improving the quality of urban transportation is a strategic element for the sustainable development of cities, simultaneously contributing to economic efficiency, social inclusion, and environmental preservation (Oum, Wu, Wang, 2024). Other studies also demonstrate that efficient and comfortable public transportation systems encourage the migration from individual transportation to collective modes, reducing pollutant emissions and improving the quality of life in urban areas (Bas et al., 2023). Furthermore, contemporary literature emphasizes that integrating urban planning, technological innovation, and logistical management of public transportation is essential to guarantee more reliable and accessible services for citizens (Sharif; Rahman, 2024). Thus, the construction of efficient, sustainable, and user-comfort-oriented urban transport systems has become a main challenge in mobility management in contemporary cities, requiring integrated approaches to planning, management, and performance evaluation (Ismail, Adu-Ampong, Aceska, 2024).

For urban transport systems to achieve high operational efficiency, environmental sustainability, and user comfort, it is essential to adopt performance measures that continuously monitor and evaluate system operations. These indicators allow strategic objectives, such as improving service quality, reducing operating costs, and increasing trip reliability, to be translated into measurable

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Pages: 1-42

parameters that guide managerial decision-making. Recent scientific literature has emphasized that well-structured performance measurement systems contribute to improving route planning, fleet sizing, and trip regularity control, factors directly related to the logistical efficiency of public transport (Pencheva et al.; Fatorachian; Kazemi, 2025). Furthermore, studies indicate that indicators related to punctuality, travel time reliability, vehicle occupancy, and user satisfaction are essential for evaluating service quality and guiding continuous improvement strategies in urban mobility systems (Huang et al., 2023). Recent research also demonstrates that the use of appropriate performance metrics enables the identification of operational failures, the reduction of resource waste, and greater integration between urban planning and public transport management (Vickerman, 2024). Thus, the adoption of consistent performance indicators is a central element in the modern management of urban transport systems, allowing managers to monitor results, adjust operations, and develop more efficient, sustainable, and citizen-oriented mobility policies (Tangar; Agardwal; Patel, 2025).

Despite significant advances in research on urban mobility and performance evaluation in public transportation systems, recent literature still reveals important gaps in the empirical application and systematic integration of performance indicators in the logistical management of urban transport fleets. Many studies focus on the conceptual development of metrics or isolated analytical models, without thoroughly examining how these measures are effectively used by managers and operators of public transportation systems in real-world city contexts (Wen et al., 2025; Colovic; Marinelli; Ottomanelli, 2024). Furthermore, it is observed that a significant portion of the research prioritizes quantitative analyses based on large operational databases, while studies analyzing professionals' perceptions of the usefulness, advantages, and limitations of the adopted performance measures remain relatively scarce (Arevalo; Gerike, 2023). This gap is particularly relevant in urban contexts with high operational complexity, where factors such as congestion, infrastructure

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Pages: 1-42

limitations, and budgetary constraints can significantly affect the effectiveness of indicators used to monitor system performance (Van Nguyen; Truong, 2025). Thus, it becomes necessary to expand investigations that seek to understand, in an integrated manner, which performance measures are used in the management of urban transport systems, their practical applications, and the limitations that may compromise their effectiveness. In this sense, the present study is justified by the need to deepen understanding of the role of these metrics in fleet logistics management and in improving the quality of urban transport services, thereby advancing scientific knowledge and improving mobility management practices in contemporary cities.

In this context, the general objective of this study was to analyze the performance measures used in the management of urban transport systems, to understand their applications, advantages, limitations, and risks of failure in the context of fleet logistics management and the operation of the urban mobility system. To achieve this purpose, three specific objectives were defined: a) to identify, in recent scientific literature, the main performance measures used in the evaluation of urban transport systems; b) to analyze, based on empirical evidence, how these measures are applied in practice by professionals involved in the management and operation of public transport; and c) to compare the results obtained in the research with the metrics widely discussed in the international literature, to verify convergences, divergences, and opportunities for improvement in the evaluation of system performance. By integrating a literature review and empirical analysis, the study seeks to advance knowledge in logistics applied to urban transport, offering a more comprehensive understanding of the role of performance indicators in improving operational efficiency, service quality, and the sustainability of urban mobility systems. Furthermore, the research aims to provide theoretical and practical support for public managers, transport operators, and mobility policymakers, thereby assisting in the development of more data-

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Pages: 1-42

driven, indicator-oriented management strategies that promote more efficient, reliable, and user-centered urban transport systems.

2. Literature Review

Performance measures are analytical tools used to measure, monitor, and evaluate the efficiency and effectiveness of processes, organizations, or systems. They allow managers and researchers to track the achievement of strategic and operational objectives. These measures are frequently integrated into structured systems called performance measurement systems (PMS), which bring together quantitative and qualitative indicators that translate organizational results into information useful for decision-making. These systems involve an articulated set of activities that includes defining indicators, systematically collecting data, analyzing results, and communicating information to different organizational stakeholders (Castelo; Gomes, 2024). Performance measures serve as mechanisms for translating strategic objectives into operational metrics, enabling evaluation of whether the actions taken achieve the expected results. Recent research also indicates that well-structured measurement systems contribute to improving organizational governance and promoting continuous improvement, especially in contexts of high complexity and economic competition (Cunha; Dinis-Carvalho; Sousa, 2023; Araújo et al., 2024; Khan, 2024). Thus, contemporary scientific literature recognizes performance measures as central to structuring data-driven, results-oriented management systems.

In addition to serving as operational monitoring tools, performance measures play a fundamental role in articulating strategic planning and organizational execution. According to recent studies published in journals indexed in the Scopus and Web of Science databases, performance indicators allow the transformation of abstract strategic objectives into measurable parameters capable of guiding managerial actions and evaluating the effectiveness of institutional policies (Cosa; Torelli, 2024; Roziq; Widyastuti;

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Pages: 1-42

Rachbini, 2025; Croitoru et al., 2025). These indicators can take different forms, including financial, operational, social, or environmental metrics, depending on the organizational context and established strategic priorities. This means that contemporary literature emphasizes the multidimensional nature of performance measurement, arguing that organizational evaluation should not be limited to financial results but should also consider service quality, user satisfaction, sustainability, and organizational innovation. This multidimensional perspective is particularly relevant in the public and essential service sectors, where operational efficiency must be balanced with the generation of social value. Thus, performance measures are understood not only as technical indicators, but also as strategic instruments of governance and accountability.

Recent scientific literature also highlights that advances in digital technologies, data analysis, and digital transformation have significantly expanded the role of performance measures in contemporary organizations. The incorporation of big data tools, management information systems, and real-time monitoring technologies enables performance indicators to be collected and analyzed more precisely, dynamically, and integratively within decision-making processes (Khan, 2024; Cunha et al., 2024; Kathuria; Lucianetti, 2025). Performance measures play a strategic role in generating organizational intelligence, enabling the identification of trends, anticipation of operational problems, and guidance for innovation and continuous improvement processes. These studies also indicate that the effectiveness of these systems depends on the appropriate selection of indicators, the quality of the collected data, and organizations' ability to interpret the information produced to support strategic decisions. Thus, performance measures are currently understood as essential components of advanced organizational management systems, contributing to the construction of more efficient, adaptive, and evidence-driven organizations. Performance measures are fundamental for assessing logistical efficiency,

RSV
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Pages: 1-42

especially in organizations responsible for urban transportation. Let's look at the most common measures found in the literature.

Punctuality is one of the most important metrics in logistics management for urban transport, as it allows evaluating the alignment between scheduled times and the effective execution of transport operations. This measure is directly associated with the reliability of the system and the ability of operating companies to maintain a regular flow of vehicles along established routes. From a logistical point of view, punctuality reflects the efficiency of route planning, fleet operational control, and the management of urban traffic conditions—factors that directly influence the quality of service provided to users. Recent studies demonstrate that transport systems with high levels of punctuality tend to achieve greater passenger satisfaction and better operational performance, as the regularity of departures and arrivals reduces waiting times and improves the predictability of urban travel. Furthermore, continuous monitoring of punctuality allows managers to identify operational bottlenecks, adjust schedules, and redistribute vehicles more efficiently. In this context, punctuality becomes a strategic tool for fleet logistics management, enabling alignment among operational planning, traffic management, and the quality of service provided to the population (Al-Suleiman et al., 2023; Tanwar; Agarwal, 2024; Rodríguez et al., 2024).

The average travel time is a key indicator for evaluating the operational efficiency of urban transport systems and guiding fleet logistics planning decisions. This measure corresponds to the time interval required for a vehicle to travel a given route, allowing for the identification of the efficiency of movement on the urban road network. From a transport logistics perspective, monitoring average travel time enables evaluation of route performance, identification of critical congestion points, and adjustment of schedules and vehicle intervals. Recent research highlights that reducing the average travel time significantly contributes to increasing the competitiveness of public transport compared to individual transport, encouraging the use of the collective system. Furthermore,

RSV
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Pages: 1-42

the systematic analysis of this metric allows for optimizing fleet sizing and the allocation of operational resources, ensuring greater efficiency in the use of available vehicles. In this way, the average travel time functions as a key indicator for the logistical management of the system, allowing for the alignment of route planning, urban traffic management, and the quality of service provided to passengers (Tanwar; Agarwal, 2024; Scháno et al., 2025; Rodríguez et al., 2024).

The regularity of the interval between vehicles, often called headway, is an essential indicator for the logistical management of public transport systems, as it measures the time between the passage of consecutive vehicles on the same line or transport corridor. This metric is particularly important in high-demand urban transport systems, where the balanced distribution of the fleet along the route directly influences the quality of service provided to passengers. From a logistical point of view, maintaining regular intervals between vehicles helps avoid overcrowding or fleet idleness, promoting a more efficient distribution of transport capacity throughout the system. Recent studies indicate that irregular vehicle spacing can lead to bus bunching, in which vehicles cluster in certain sections of the route, reducing system operational efficiency. Therefore, headway monitoring enables managers to implement real-time operational control strategies, adjusting vehicle speeds or redistributing the fleet based on traffic and demand conditions. Thus, this measure plays a central role in the logistical management of urban transport, contributing to improved service reliability and fleet utilization efficiency (Rashvand et al., 2024; Tanwar; Agarwal, 2024; Al-Suleiman et al., 2023).

The fleet occupancy rate, also known as the load factor, is a key indicator of vehicle capacity utilization efficiency. This metric corresponds to the ratio of the number of passengers transported to the maximum available capacity of the vehicles, allowing the identification of the fleet utilization level across different routes and schedules within the system. From the perspective of urban transport logistics, the occupancy rate plays a crucial role in fleet sizing and trip frequency determination, as it enables adjusting the transport supply to actual passenger

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Pages: 1-42

demand. Recent studies indicate that systematic analysis of this indicator can reduce operational costs, avoid resource waste, and improve the energy efficiency of the public transport system. In addition, the occupancy rate provides important information for strategic route planning and for defining tariff and system expansion policies. Thus, this measure constitutes an essential instrument for fleet logistics management, contributing to optimizing the balance between supply and demand in urban transport (Rodríguez et al., 2024; Sousa Júnior et al., 2023; Nancy, 2025). Table 1 presents the most common types of performance measures in the current scientific literature.

Table 1. Performance measures in urban transport companies: Most found in recent literature

Measurements	Application	Advantages	Disadvantages	Risks of failure	References
Punctuality of trips	Evaluates whether vehicles arrive or depart on schedule	Measures service reliability and improves operational planning	Can be affected by external factors such as congestion or accidents	Errors in timekeeping or GPS failures	Al-Suleiman et al. (2023); Deligiannis; Madas (2026); Sivakumar et al. (2025)
Average travel time	Measures the time required to complete a journey or route	Identifies operational bottlenecks and improves routes	Sensitive to variations in urban traffic	Incomplete data or inaccurate records	Tanwar; Agarwal (2024); Wang et al. (2025); Imbugwa et al. (2025); Gautam et al. (2025
Regularity of vehicle intervals (Headway)	Monitors the interval between consecutive vehicles on the same line	Helps maintain a balanced fleet distribution	Difficult to control in congested systems	Failures in tracking or monitoring systems	Rashvand et al. (2025); Mishra; Sing (2026); Zare et al. (2025)
Load factor	Measures the proportion of passengers transported in relation to the vehicle's capacity	Adjusts transport supply to demand	It can vary greatly between peak and off-peak hours	Failures in ticketing or passenger counting systems	Rodríguez et al. (2024); Dumedah et al. (2025); Opurum (2026)
Service availability	Evaluates vehicle frequency and system coverage	Indicates accessibility and transport supply	May require large volumes of operational data	Failures in recording scheduled trips	Rodríguez et al. (2024); Thilakshan; Bandara (2025); Mitropoulos et al. (2026)
User satisfaction	Evaluates passengers' perception of service quality	Identifies necessary improvements in user experience	Based on subjective perception	Inadequate sampling or response bias	Rodríguez et al. (2025); Ismael (2026); Aburomman;

RSV
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Pages: 1-42

					Alshdaifat (2026)
Reliability of travel time	Evaluates variations between real-time and estimated travel time	Increases transport predictability	Difficult to control in complex urban environments	Sensor failures or data inconsistency	Scháno et al. (2025); Ransikarbum et al. (2026); Guerrieri; Sanfilippo (2026)
Transport system coverage	Measures the proportion of the population served by transport stops or lines	Assists in territorial planning and accessibility	Does not assess the quality of service provided	Errors in the geographic database	Sharma et al. (2025) ; Parkavi; Parthiban (2025)
Average operating speed	Evaluates the efficiency of vehicle movement in the urban network	Identifies congestion and optimizes routes	Influenced by factors external to the system	GPS or sensor reading errors	Tanwar; Agarwal (2024); Geremew (2026)
Number of passengers transported	Measures the effective demand of the transport system	Assesses financial sustainability and sizes the fleet	May not reflect service quality	Failures in electronic ticketing	Sousa Júnior et al. (2023); Urbano et al. (2025)

Source: data collected by the authors.

Service availability refers to the capacity of the urban transport system to offer sufficient vehicles and routes to meet the population's demand over time and across urban areas. This measure is related to trip frequency, route coverage, and the presence of vehicles in operation at different times of day. In the context of fleet logistics management, service availability is a fundamental indicator for evaluating the adequacy of transport supply to the population's mobility needs. Recent studies demonstrate that high availability is associated with higher urban accessibility and greater public transport use. Furthermore, this metric enables managers to identify gaps in system coverage and implement strategies to expand or restructure routes. Analyzing availability also helps optimize vehicle allocation, ensuring the fleet is efficiently distributed throughout the transport network. Thus, service availability constitutes a strategic indicator for the logistical management of urban transport, allowing for the alignment of operational planning, territorial accessibility, and the quality of service provided to the population (Rodríguez et al., 2024; Nancy, 2025; Tanwar; Agarwal, 2024).

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Pages: 1-42

User satisfaction is a performance measure that evaluates passengers' perceptions of the quality of urban transport services. This metric is generally obtained through opinion surveys that analyze aspects such as punctuality, comfort, safety, vehicle cleanliness, and user service. Although it is a perceptual indicator, user satisfaction is strongly related to the logistical management of the transport system, as it reflects the effectiveness of the operational decisions adopted by managers. Recent studies indicate that high passenger satisfaction is associated with system operational efficiency, trip regularity, and the quality of the transport infrastructure. In addition, user satisfaction analysis enables the identification of service failures and guides continuous improvement in fleet and route management. Thus, this indicator plays a relevant role in the strategic management of urban transport, contributing to aligning operational efficiency and the perceived quality of the service provided to the population (Rodríguez et al., 2025; Nancy, 2025; Sousa Júnior et al., 2023).

Travel time reliability is an essential indicator for assessing the predictability of travel in urban transport systems. Unlike average travel time, which measures the average duration of journeys, reliability analyzes the variability of these times over different periods and traffic conditions. From a logistics management perspective, this measure allows for assessing the stability of the transport system and its ability to maintain consistent operational performance. Recent studies demonstrate that high reliability increases user confidence in public transport and reduces the uncertainty associated with travel planning. Furthermore, monitoring travel time reliability enables managers to identify critical routes, adjust itineraries, and implement strategies to prioritize public transport on urban roads. This metric plays a fundamental role in fleet logistics management, contributing to improving the operational efficiency and predictability of the urban transport system (Scháno et al., 2025; Tanwar; Agarwal, 2024; Al-Suleiman et al., 2023).

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Pages: 1-42

Transportation system coverage refers to the territorial and population extent served by the routes and stops of urban public transportation. This measure allows evaluating the degree of accessibility provided by the system and identifying city regions with greater or lesser availability of public mobility services. From a logistics management perspective, system coverage serves as a strategic indicator for transportation network planning, guiding decisions on route expansion, new corridor creation, and fleet redistribution. Studies show that transportation systems with greater territorial coverage tend to promote greater social inclusion and better integration across urban areas. Furthermore, coverage analysis enables the identification of spatial inequalities in access to public transportation and guides public policies to improve urban mobility. Thus, this measure plays a central role in the logistics management of urban transportation, contributing to aligning territorial planning, accessibility, and the operational efficiency of the system (Nancy, 2025; Sousa Júnior et al., 2023; Rodríguez et al., 2024).

Average operating speed is an indicator used to assess the efficiency of vehicle movement on the urban road network. This metric is the ratio of distance traveled to total travel time, including stops and any delays along the route. From the perspective of fleet logistics management, average operating speed provides important information about vehicle circulation conditions and the efficiency of routes used in the urban transport system. Recent studies indicate that improving operating speed can significantly reduce operating costs, increase fleet productivity, and enhance the competitiveness of public transport relative to individual transport. In addition, analyzing this indicator allows identifying critical sections of the road network with congestion or infrastructure issues. Thus, average operating speed is a relevant measure for logistics management in urban transport, enabling alignment among route planning, traffic management, and the operational efficiency of the system (Tanwar; Agarwal, 2024; Scháno et al., 2025; Al-Suleiman et al., 2023).

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Pages: 1-42

The number of passengers transported is one of the most widely used indicators for evaluating the performance of urban public transport systems. This measure corresponds to the total number of users who use the system over a given period, providing important information about demand and service use. In the context of fleet logistics management, this indicator plays a fundamental role in sizing transport capacity, enabling the number of vehicles in operation to be adjusted to actual passenger demand. Recent studies demonstrate that analyzing passenger demand improves route planning, optimizes trip frequency, and reduces operational costs associated with fleet underutilization. Furthermore, monitoring this indicator enables identification of trends in demand growth or decline, assisting managers in defining strategies to expand or restructure the urban transport system. Thus, the number of passengers transported is an essential indicator for logistics management in urban transport, contributing to aligning transport supply with operational efficiency and the economic sustainability of the system (Sousa Júnior et al., 2023; Rodríguez et al., 2024; Nancy, 2025).

3. Research Methodology

This is a qualitative research study, with data collected at the nominal measurement level, whose unit of analysis was individual, in which the respondents were representatives of each company that provides urban transport in the city of Manaus, at the systemic level of analysis, since the intention was to understand the performance measures of the entire urban transport system, and from a cross-sectional, synchronic or cross-sectional perspective, which is characterized by the description of the present reality as if it were a photograph (Nascimento-e-Silva, 2020; 2021a).

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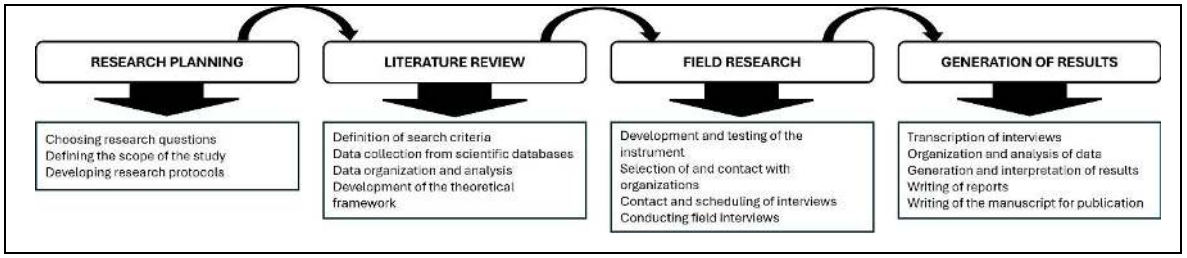
3.1 Guiding Questions

The overall objective of the study was divided into six guiding questions that directed all data collection and interpretation: 1) What performance measures are used by urban transport companies? 2) How are these measures applied in daily operations? 3) What advantages are perceived by workers in the use of these measures? 4) What disadvantages or limitations are identified in the use of these indicators? 5) What are the main failure risks associated with the measures adopted? The entire study was designed to answer these questions (Nascimento-e-Silva, 2021b).

3.2 Study Design

The results of this research were generated from the execution of four stages. The first stage was planning, during which the main and guiding research questions were selected, the scope of the study was defined, and the protocols for the literature review and field research were developed. The second stage was the literature review, which consisted of defining the search and data collection standards in scientific databases (Google Scholar, Wiley, Taylor & Francis, Scopus, and Web of Science), followed by the organization and analysis of the collected data, which were used to develop the theoretical framework of the field research (Silva et al., 2026). Figure 1 shows the methodological path followed.

Figure 1. Study design.



Source: prepared by the authors.

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Pages: 1-42

The third stage was field research, which began with the development, testing, and refinement of the data collection instrument, followed by selecting and contacting organizations that provide urban public transportation services in Manaus to obtain permission and schedule interviews, culminating in the collection of empirical data. The fourth and final stage was the generation of results, which began with transcribing the interviews into a word processor and continued with the organization and analysis of the collected data, yielding the study results. These results were then compared with the theoretical framework developed in the literature review stage, culminating in the writing of the research reports. The report was used to format this article for submission to publication.

3.3 Population, Sample, and Research Subjects

The research population consisted of the seven companies officially authorized to provide urban transportation services in the city of Manaus, Brazil. The sample consisted of six respondents who were willing to provide information and had their companies' authorization to do so. The demographics of the six participants reveal a group predominantly composed of adults in full professional maturity, which presupposes adequate cognitive and operational capacity to understand and evaluate the performance measures used in urban transport. The respondents' ages range from 35 to 47 years, indicating a sample composed of professionals with accumulated experience and sufficient expertise to recognize the demands and limitations of the work environment. The predominant level of education is high school, a level that, although sufficient for many practical functions in the sector, may restrict access to formal management approaches and hinder a deeper understanding of the benefits of standardized procedures, especially those related to indicators and operational control. The respondents' professional training reinforces this scenario. Although some have specific qualifications, such as traffic enforcement courses, transport driving, or technical training in mechanics, others stated that they do not have formal professional

RSV
ISSN 2674-8584

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Vol: 08.03
DOI: 10.66104/znn1re84
Pages: 1-42

training. This diversity of practical training, combined with predominantly intermediate schooling, helps explain why some workers recognize the existence of performance measures but struggle to relate directly to operational improvement or organizational efficiency.

The respondents' length of service ranges from 5 to 19 years, while their total experience in the transportation sector ranges from 10 to 20 years. These numbers reveal a group of workers who are highly familiar with urban transportation routines and can identify operational problems, structural limitations, and daily challenges. However, this long tenure in the sector does not necessarily translate into mastery of management tools, which indicates that, despite consistent practical experience, there is still a lack of continuous training programs that reinforce a culture of quality, standardization, and indicator analysis.

Regarding the performance profile, it is observed that the main clients served (urban population, passengers, and system users) directly influence how workers perceive the importance of operational performance. Similarly, the reference suppliers vary across workshops, manufacturers, residents, and regional suppliers, revealing that workers are embedded in a complex, diverse operational chain. These characteristics reinforce the importance of understanding how each professional, based on their role and experience, assigns meaning to the performance measures implemented in companies.

Overall, the demographic aspects of the sample demonstrate that the participants possess a solid practical repertoire, built up over the years, but still lack greater theoretical and technical alignment to fully understand the role of performance measures in improving efficiency and reducing failures in urban transport operations. This scenario underscores the need for professional development strategies that not only provide technical training but also foster a broader understanding of management tools, thereby enhancing the quality and reliability of the services provided.

RSV
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Vol: 08.03
DOI: 10.66104/znn1re84
Pages: 1-42

3.4 Business Aspects of the Researched Organizations

All the researched organizations are from the state of Amazonas, indicating a specific regional focus. Regarding the field of activity, only one company is in the government sector and operates in the inspection area. The others are service-sector companies with a greater focus on urban transport. Among the main services offered, the most prominent are public passenger transport, complementary urban transport, and the operation of urban lines, including inter-neighborhood routes. The data reveal that the analyzed group is mostly linked to the municipal urban mobility system, performing essential functions for the daily commute of the population. Thus, the table highlights the concentration of respondents in activities related to public transport and traffic organization in the region.

The time the surveyed companies have been in operation in the market ranges from 13 to 40 years, indicating that all organizations have a consolidated trajectory. The company with the longest operating time has been in business for 40 years, while the most recent has been in business for 13 years. Regarding the number of employees, there is significant variation, ranging from 210 to 1,200. The largest operational structure has 1,200 employees, while the smallest has 210. This difference demonstrates the diversity of organizational sizes, ranging from medium to large companies. The data reveals that the analyzed companies are stable in the sector and maintain strong teams, reflecting their relevance in the markets they operate in.

3.5 Data Collection Instrument

The final version of the data collection instrument consisted of two data groupings. The first was the sociodemographic and business grouping, used to collect data on the respondents (such as age, length of service, and technical training) and the organization surveyed (such as time in the market, number of employees, etc.). The second group consisted of explanatory questions, which

RSV
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Vol: 08.03
DOI: 10.66104/znn1re84
Pages: 1-42

focused on the object of study: 1) the performance measures used by the companies, 2) the operationalization of these measures, 3) the perceived advantages of using these measures, 4) the disadvantages or limitations identified in the use of the indicators, and 5) the main risks of failure associated with the measures adopted.

3.6 Data Collection Strategy

To collect data on respondents' age, education level, and professional training, we followed a standardized procedure that is easily reproducible by anyone. First, we defined the group of participants that comprised the study sample, totaling six respondents. Then, we applied a structured form with objective questions about three main aspects: age, education level, and professional training. Each participant completed the form individually, stating their age in complete years, their level of education (e.g., high school or higher education), and their specific professional training. The answers were recorded exactly as provided by the participants, including cases where the respondent chose not to provide certain information, as occurred with one of them in the "professional training" field. After collection, we organized the information in a table, assigning each respondent an identifying number (1-6) to preserve participants' anonymity. The resulting table presents the ages, education levels, and declared professional training, enabling clear, direct visualization of the data. This procedure ensures that anyone can repeat the process: apply the same form, record the answers faithfully, and organize the results following the same pattern presented.

3.7 Data: Instrument, Data Organization, and Analysis Techniques

The interview script was developed to present, in an organized manner, information on the respondents' length of service with the company and professional experience. To this end, we adopted a standardized procedure to

RSV
ISSN 2674-8584

Received: 13/04/2026 - **Accepted:** 27/05/2026
Vol: 08.03
DOI: 10.66104/znn1re84
Pages: 1-42

record and compare this data correctly. Initially, we defined the variables that would compose the table, aligned with the research objectives: length of service in the company and professional experience. Then, we structured the table with three main columns, in addition to the identification column: Respondent, Length of service in the company, and Professional experience. The "Respondent" column was numbered from 1 to 6, guaranteeing anonymity and allowing for the sequential organization of the participants. After the questionnaires were administered, each respondent directly reported their length of service in their current company and their total professional experience in the field. These responses were initially recorded in a base spreadsheet and subsequently transferred to the final table.

During the filling process, we maintained a simple numerical pattern (only values in years), exactly respecting the answers provided. There were no omissions or incomplete answers in this table; therefore, all fields were fully completed. After transcription, we conducted a general review to ensure consistency and avoid typing errors, ensuring that the data presented faithfully reflected the original collection. Thus, the Table clearly and objectively summarizes the professional profiles of the participants, allowing direct visualization of accumulated experience time and length of stay in the company, and enabling comparisons between respondents and additional analyses throughout the research.

3.8 Techniques for Generating and Interpreting Results

To answer the guiding research questions, we followed a systematic process of reading, organizing, and interpreting the information in each table (Nascimento-e-Silva, 2021c; Silva et al., 2026). First, we identified which variables each table presented and what essential question it helped to answer. Then, we extracted raw data on ages, length of service, education levels, clients, suppliers, and performance measures. From these values, we performed simple descriptive

RSV
ISSN 2674-8584

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Vol: 08.03
DOI: 10.66104/znn1re84
Pages: 1-42

analyses to characterize profiles, identify patterns, and detect possible inconsistencies. After that, we grouped the data by themes, such as operational performance, professional profile, business structure, and supply chain, which allowed us to transform isolated numbers into coherent interpretations. Each table was also constructed with practical relationships to the operational realities of the companies, evaluating how the collected indicators influence planning, efficiency, customer service, and the risks of failure. Measures such as travel time, occupancy, and satisfaction were interpreted in light of their advantages, limitations, and applications. Information on worker and company profiles was converted into descriptions that contextualize the experience, structure, and target audience. Thus, each essay produced was based on both the objective data in the table and an interpretative analysis that connects them to the research objectives. With this method, we ensured that each response was faithful to the information collected, consistent with the proposed questions, and appropriate to the required academic format.

4. Results and Discussion

The presentation of the study results will follow the order of the responses to the guiding questions. The answer to the central research question is presented in the discussion of the results.

4.1 Performance Measures Practiced

Table 2 presents a structured set of performance measures for monitoring and evaluating the operation of public transportation systems. The table gathers information from different respondents, identified numerically, and organizes the metrics into four main elements: the respondent's identification, the performance measure mentioned, the conceptual description of the measure, and the analytical focus to which it is associated. Indicators related to temporal control of operations

RSV
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Vol: 08.03
DOI: 10.66104/znn1re84
Pages: 1-42

are observed, including trip completion, average trip time, and average travel time per segment. In parallel, metrics focused on fleet occupancy are emerging, including average vehicle occupancy, load factor, average occupancy per trip, and fleet technical availability. The table also includes indicators related to user perception, such as complaint and user satisfaction rates, as well as metrics associated with route operational efficiency, including departure and arrival punctuality, fuel consumption, and the route reliability index. Thus, the table's structure highlights a wide range of variables used to monitor both operational efficiency and perceived service quality.

Table 2. Performance measures implemented.

Resp	Measures	Description of the measures	Focus
01	Travel Completion	Number of planned trips	Time
03	Average travel time	Total time per route	
05	Average travel time per segment	Actual time between key points on the route	
01	Average Vehicle Occupancy	Electronic registration number	Occupancy
03	Occupancy Rate	Average number of passengers per trip	
04	Average Occupancy per Trip	Percentage of seats occupied	
06	Technical availability of the fleet	Vehicles available in operation vs. total fleet	
02	Complaints index	Passenger complaints	Clients
06	User satisfaction	User ratings	
04	Punctuality of Departures/Arrivals	Trips completed within the allowed timeframe	Routes/Trips
02	Fuel consumption	Average cost per trip	
05	Route reliability index	Scheduled trips completed by route	

Source: data collected by the authors.

These data reveal that performance evaluation in the studied transportation system follows a multidimensional operational monitoring logic. The identified measures indicate that the system's performance is evaluated not only from an operational perspective but also from economic efficiency, service quality, and

RSV
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Vol: 08.03
DOI: 10.66104/znn1re84
Pages: 1-42

user experience. The indicators are organized into four main axes: operational time, fleet occupancy, customer perception, and route and trip performance. This structure suggests a management approach oriented towards integrating operational productivity and user satisfaction, highlighting a simultaneous concern with the system's efficiency and the quality of service provided to the population. Thus, the data logic demonstrates that the performance evaluation system seeks to capture different dimensions of public transportation's functioning, enabling a more comprehensive analysis of the service's operational effectiveness.

4.2 How the Measures are Applied

Table 3 presents the operational procedures used to apply the previously identified performance measures. As in the previous table, the data are organized by respondents, the metrics analyzed, the application method, and the analytical focus. Regarding operational time measures, it is observed that trip completion is monitored through manual records kept by the supervisors responsible for overseeing operations. The average trip time is calculated by controlling schedules and analyzing delays along the route, while the average time per segment uses GPS geolocation data. Fleet occupancy metrics predominantly use information and communication technologies, such as electronic records and passenger-average calculations, to adjust the available fleet. In the area of user perception, complaint rates are recorded and evaluated by management, while user satisfaction is measured through in-person and digital surveys. Route efficiency metrics, such as punctuality, fuel consumption, and route reliability, use mileage records, comparison of scheduled times, and percentage calculations of departure completion.

RSV
ISSN 2674-8584

Received: 13/04/2026 - **Accepted:** 27/05/2026
Vol: 08.03
DOI: 10.66104/znn1re84
Pages: 1-42

Table 3. How the measures are applied

Resp	Measures	How they are applied	Focus
01	Travel Completion	Manual registration by the inspector	Time
03	Average travel time	Control of schedules and analysis of delays	
05	Average travel time per segment	GPS analysis for schedule adjustments	
01	Average Vehicle Occupancy	Use of ICT	Occupancy
03	Occupancy Rate	Average passenger count used to adjust the fleet	
04	Average Occupancy per Trip	Calculation of the average occupancy rate to adjust the fleet	
06	Technical availability of the fleet	Daily monitoring and maintenance plan	
02	Complaints index	Complaints registered and evaluated by management	Clients
06	User satisfaction	In-person and digital surveys	
02	Punctuality of Departures/Arrivals	Fuel consumption calculated per km recorded	Routes/Trips
04	Fuel consumption	GPS comparison with scheduled times	
05	Route reliability index	Daily percentage of departure compliance	

Source: data collected by the authors.

These findings show that monitoring the operational performance of the transportation system relies on a hybrid data-collection and analysis model. This model combines traditional administrative control practices, such as manual records and direct inspection, with digital monitoring technologies, such as GPS systems and information technology tools. This combination suggests that the analyzed system is at an intermediate stage of technological modernization, where conventional methods still coexist with more advanced digital solutions. The underlying logic of this structure indicates that organizations responsible for operating transportation seek to increase measurement accuracy and enhance managerial control capacity, without completely abandoning traditional operational supervision procedures. Thus, the data reveal a gradual transition process towards the digitalization of performance monitoring systems.

RSV
ISSN 2674-8584

Received: 13/04/2026 - **Accepted:** 27/05/2026
Vol: 08.03
DOI: 10.66104/znn1re84
Pages: 1-42

4.3 Advantages of the measures implemented

Table 4 presents the main advantages of the performance measures identified in the study. The advantages of temporal metrics include ensuring the appropriate number of trips are completed and improving the regularity and operational organization of routes. Monitoring the average time per segment is considered a relevant tool for improving the planning of vehicle circulation schedules. Regarding metrics related to fleet occupancy, respondents highlight benefits such as optimizing vehicle use, preventing overcrowding, and reducing low-demand trips. The technical availability of the fleet is considered an important indicator for increasing operational efficiency. In relation to user satisfaction indicators, the complaint rate identifies service failures, while satisfaction surveys measure passenger perception. Finally, route-related metrics, such as punctuality and reliability, are considered fundamental tools for evaluating operational efficiency and improving schedule planning.

Table 4. Advantages of the performance measures practiced

Resp	Measures	Advantages	Focus
01	Travel completion	Ensures correct quantity and identifies failures	Time
03	Average travel time	Improves regularity and organization	
05	Average travel time/segment	Improves schedule planning	
01	Average vehicle occupancy	Optimizes fleet operation	Occupancy
03	Occupancy rate	Avoids overcrowding or empty trips	
04	Average occupancy/trip	Allows for fleet optimization and cost reduction.	
06	Fleet availability	Fleet efficiency.	
02	Complaints index	Knowledge of service failures	Clients
06	User satisfaction	Measures user perception.	
02	Fuel consumption	Improves service and identifies inadequacies	Routes/Trips
04	Punctuality Departure / Arrival	Measures reliability and operational efficiency	
05	Route reliability index	Evaluates operational effectiveness and improves schedule planning	

Source: data collected by the authors.

RSV
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Received: 13/04/2026 - **Accepted:** 27/05/2026
Vol: 08.03
DOI: 10.66104/znn1re84
Pages: 1-42

The results reveal that performance measures play a strategic role in the management of urban transport systems. The logic underlying the identified advantages indicates that these indicators serve as essential tools for managerial decision-making, enabling continuous adjustments to the system's operations. By providing information on regularity, fleet occupancy, energy efficiency, and user satisfaction, the analyzed metrics offer a comprehensive view of the service's functioning. This approach favors the implementation of evidence-based management practices, in which operational decisions are based on empirical data. Thus, the results demonstrate that the systematic use of performance indicators significantly improves operational efficiency and enhances the quality of public transport services.

4.4 Disadvantages of the Practiced Measures

Table 5 presents the main disadvantages associated with the performance measures used in the system analyzed. Among the identified disadvantages, reliance on manual records for some metrics, such as trip completion and average trip time, can lead to delays or inconsistencies in data collection. The average time per segment is considered sensitive to external events, such as congestion, accidents, or unforeseen changes in traffic conditions. Regarding fleet occupancy metrics, technical issues with electronic ticketing systems and manual passenger counting difficulties are noted. Average occupancy per trip can be distorted when the sample used does not adequately reflect operational reality. Furthermore, the technical availability of the fleet requires a detailed maintenance control system. In the area of user evaluation, the possibility of bias in satisfaction surveys is highlighted. Operational indicators, such as punctuality and route reliability, may fail to account for important qualitative factors, such as passenger comfort.

RSV
ISSN 2674-8584

Received: 13/04/2026 - **Accepted:** 27/05/2026
Vol: 08.03
DOI: 10.66104/znn1re84
Pages: 1-42

Table 5. Advantages and disadvantages of the measures

Resp	Measures	Disadvantages	Focus
01	Travel completion	Manual registration causes delays	Time
03	Average travel time	It depends on manual registration	
05	Average travel time/segment	Sensitive to external events	
01	Average vehicle occupancy	Card malfunctions prevent users from entering	Occupancy
03	Occupancy rate	Manual counting can fail	
04	Average occupancy/trip	Poor sampling distorts results	
06	Fleet availability	Requires detailed control	
02	Complaints index	Requires prompt attention	Clients
06	User satisfaction	Sampling can be biased	
02	Fuel consumption	Incomplete complaints can cause problems	Routes / Trips
04	Punctuality Departure / Arrival	It does not consider passenger comfort	
05	Route reliability index	It doesn't measure comfort; it's sensitive to external events	

Source: data collected by the authors.

These findings demonstrate that, despite their managerial relevance, performance measures have structural limitations that can compromise the accuracy of evaluations. The data suggest that many indicators depend on data-collection processes that are still subject to human error or technological limitations. Furthermore, some operational indicators capture only quantitative aspects of performance, failing to consider qualitative dimensions important to the user experience. Therefore, the results indicate the need to improve both data collection systems and the indicators used in performance evaluation. The incorporation of more advanced technologies and qualitative metrics could make the monitoring system more robust and better reflect the operational reality of public transportation.

RSV
ISSN 2674-8584

Received: 13/04/2026 - **Accepted:** 27/05/2026
Vol: 08.03
DOI: 10.66104/znn1re84
Pages: 1-42

4.5 Main Risks of Failure

Table 6 presents the main risks of failure associated with the application of performance measures in the public transportation system. Risks related to temporal metrics include inaccurate recordings during peak hours, oversights in recording information, and interference caused by adverse traffic conditions or unexpected route changes. The average travel time per segment can be affected by GPS failures or by extreme values that are not adequately handled in the analyses. Regarding fleet occupancy metrics, problems related to failures in electronic validators, data loss, or passenger counting errors stand out. The technical availability of the fleet can be compromised by underreporting of mechanical failures. In the area of user evaluation, risks include the unavailability of complaint registration systems and distortions in satisfaction surveys due to inadequate sampling. Operational indicators, such as fuel consumption, punctuality, and route reliability, can be affected by mileage errors, technological failures, or incorrect records in emergency situations.

Table 6. Main failure risks

Resp	Measures	Risks of Failures	Focus
01	Travel completion	Inaccurate record-keeping during peak hours	Time
03	Average travel time	Forgetfulness, traffic, and route changes	
05	Average travel time	GPS failures or unhandled outliers	
01	Average vehicle occupancy	Problems: validators, data loss, counting	Occupancy
03	Occupancy rate	Passengers get out of the stop, and there are counting errors	
04	Average occupancy/trip	Non-representative sampling	
06	Fleet availability	Underreporting of technical failures	
02	Complaints index	System downtime and loss of records	Clients
06	User satisfaction	Distorted sampling in surveys	
02	Fuel consumption	Mileage errors and mechanical failures	Routes/Trips
04	Punctuality	GPS failures or time manipulation	
05	Route reliability index	Incorrect records in emergencies	

Source: data collected by the authors.

RSV
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Vol: 08.03
DOI: 10.66104/znn1re84
Pages: 1-42

These results reveal that the reliability of performance evaluation systems depends directly on the quality of the mechanisms for collecting, recording, and processing operational information. The identified risks demonstrate that performance measurement in complex urban transport systems is subject to multiple sources of error, including human factors, technological limitations, and external environmental factors. This scenario highlights the importance of implementing data verification, validation, and integration systems to reduce inconsistencies and improve measurement accuracy. Furthermore, the results indicate that adopting more advanced monitoring technologies, combined with standardized information recording procedures, can significantly help minimize the risk of failures and improve the reliability of indicators used in public transport management.

4.6 Discussion of Results

The analyzed transport system uses a diverse set of indicators to monitor its operational performance, including trip completion, average travel time, average time per segment, average vehicle occupancy, load factor, user satisfaction, and route reliability indicators. This structure is largely consistent with the performance measures identified in recent scientific literature on urban transportation. Recent studies indicate that indicators such as trip punctuality, average travel time, travel time reliability, and fleet occupancy rate constitute central metrics for evaluating the logistical efficiency of public transportation systems (Al-Suleiman et al., 2023; Tanwar; Agarwal, 2024; Fedujwar; Agarwal, 2024). Similarly, international research also highlights the relevance of user satisfaction as a complementary performance indicator, since the quality perceived by passengers directly influences the attractiveness of public transportation (Rodríguez et al., 2025). Thus, the indicators used in the investigated system align with the practices recommended by contemporary scientific literature, encompassing operational, logistical, and service quality

RSV
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Vol: 08.03
DOI: 10.66104/znn1re84
Pages: 1-42

dimensions. This means that the measures adopted in the organization studied reflect a performance evaluation model compatible with the analytical standards of recent scientific literature on urban transportation.

Performance measures in the investigated system are applied through a combination of traditional monitoring methods and technological data collection tools. The use of manual records to control trip completion and GPS systems to monitor average travel time per segment indicates a hybrid operational management model. This pattern is also evident in recent studies on performance evaluation in urban transport, which demonstrate that the integration of digital monitoring technologies and traditional administrative practices is a common characteristic of transport systems undergoing modernization (Tanwar; Agarwal, 2024; Scháno et al., 2025; Sousa Júnior et al., 2023). The literature also highlights that the use of geolocation and electronic ticketing systems increases the accuracy of measurements of trip punctuality, travel time, and vehicle occupancy rate, significantly improving the fleet's logistical management capacity (Fedujwar; Agarwal, 2024). In this sense, the empirical results of the research confirm trends already identified in international studies on public transportation systems. It is concluded that the model for applying performance measures observed in the study reflects a gradual process of digitalization in the logistics management of urban transportation.

The performance measures used in the investigated system provide significant benefits for operational management of urban transport, particularly by improving route regularity, optimizing fleet utilization, and monitoring user satisfaction. These benefits align with the advantages described in recent scientific literature on performance evaluation in public transport systems. International research demonstrates that indicators such as trip punctuality, travel time reliability, and fleet occupancy rate are fundamental to improving the logistical efficiency of the system and reducing operational costs (Al-Suleiman et al., 2023; Fedujwar; Agarwal, 2024; Nancy, 2025). Furthermore, user satisfaction

RSV
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Vol: 08.03
DOI: 10.66104/znn1re84
Pages: 1-42

analysis is frequently cited as an essential tool for evaluating service quality and guiding continuous improvement processes in public transport management (Rodríguez et al., 2025). Thus, the identified advantages are broadly aligned with the results reported in the international scientific literature. Therefore, the performance measures adopted in the system studied effectively contribute to strengthening the operational efficiency and quality of urban transport services.

The main disadvantages of the performance measures used in the investigated system are their dependence on manual records, their sensitivity to external factors such as congestion, and the possibility of failures in electronic ticketing systems. These challenges are also widely discussed in the scientific literature on urban transport management. Recent studies highlight that indicators such as trip punctuality and average travel time can vary significantly depending on factors external to the transport system, such as traffic conditions, unforeseen events, and limitations of urban infrastructure (Tanwar; Agarwal, 2024; Scháno et al., 2025). In addition, research indicates that manual record-based monitoring systems may limit the accuracy and reliability of collected data (Sousa Júnior et al., 2023). The literature also notes that an exclusive focus on quantitative indicators may overlook qualitative aspects of the user experience, such as comfort and safety. Thus, the research results confirm the structural challenges already identified in international studies on performance evaluation in public transport. Therefore, the limitations observed in the investigated system reflect common operational challenges in urban transport systems undergoing technological modernization.

The main risks associated with the performance measures used in the analyzed system are failures in data recording, technical problems with monitoring systems, and interference from external factors, such as traffic conditions or unexpected events on the routes. These risks are also widely discussed in recent scientific literature on performance evaluation in urban transport. Research indicates that indicators based on GPS systems, electronic ticketing, and

RSV
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Vol: 08.03
DOI: 10.66104/znn1re84
Pages: 1-42

monitoring sensors can be distorted by technological failures or inconsistencies in data collection (Scháno et al., 2025; Nancy, 2025). In addition, studies highlight that human errors in recording operational information can compromise the reliability of the metrics used in fleet logistics management (Sousa Júnior et al., 2023). In this context, the literature emphasizes the importance of implementing integrated monitoring systems that can validate and cross-reference data from different sources. This means that the risks identified in the research correspond to typical vulnerabilities of performance measurement systems in complex operational environments, such as urban transport.

A comparative analysis between the research results and the performance measures identified in recent scientific literature demonstrates a high degree of convergence between the indicators used in the investigated system and those recommended by international studies on performance evaluation in urban transport. The metrics identified in the research, such as trip punctuality, average travel time, fleet occupancy rate, user satisfaction, and route reliability, correspond directly to the indicators widely used in the literature to evaluate the logistical efficiency and quality of public transport service (Al-Suleiman et al., 2023; Tanwar; Agarwal, 2024; Fedujwar; Agarwal, 2024; Nancy, 2025). At the same time, the empirical results highlight operational challenges like those observed in other urban transport systems, including limitations in data collection, reliance on manual records, and technological vulnerabilities in monitoring systems. Thus, it is confirmed that the analyzed system presents a performance evaluation model aligned with contemporary practices in urban transport management. However, there are still opportunities to improve the digitization of monitoring processes and the integration of information systems. In summary, the research results reinforce the importance of performance measures as strategic instruments for the logistical management of the fleet and for the continuous improvement of the efficiency and quality of urban public transport.

RSV
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Received: 13/04/2026 - **Accepted:** 27/05/2026
Vol: 08.03
DOI: 10.66104/znn1re84
Pages: 1-42

5. Conclusion

This study showed that the urban transport system of the city of Manaus presents indicators that are closely aligned with the practices adopted in international studies on performance evaluation in public transport. It was observed that metrics such as trip punctuality, average travel time, fleet occupancy rate, regularity of the vehicle interval, user satisfaction, and route reliability are reported in both the scientific literature and the research results. This convergence shows that the evaluation mechanisms of the analyzed system reflect a management logic based on operational and service quality indicators, aimed at monitoring the logistical efficiency of the fleet and the passenger experience. However, the analysis also revealed limitations associated with reliance on manual records, the vulnerability of some technological systems, and the influence of external factors such as congestion and urban traffic conditions. Thus, although the indicators adopted are consistent with recommendations from the scientific literature, the results indicate that improving data collection and processing systems can significantly increase the reliability of performance evaluations and strengthen the logistical management of urban transport.

Regarding the study's contributions, it is noteworthy that there is empirical evidence on the practical application of performance measures in logistics management for urban transport systems. By identifying which indicators are used, how they are applied, and their main advantages, limitations, and risks of failure, the study contributes to broadening the understanding of performance evaluation mechanisms in the context of urban mobility. The results also demonstrate that the systematic use of operational indicators can support decision-making processes related to route planning, fleet sizing, improving trip punctuality, and optimizing vehicle utilization. The study contributes to the development of more efficient management practices in the urban transport sector, providing support for public managers and private operators to improve system logistics and raise the quality of service provided to the population. In

RSV
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Vol: 08.03
DOI: 10.66104/znn1re84
Pages: 1-42

academic terms, the research advances the field of logistics applied to urban mobility by integrating empirical evidence with the recent theoretical framework for performance evaluation in transport systems.

Considering the limitations and opportunities identified throughout the research, three main directions for future studies can be suggested. The first refers to the development of more advanced quantitative models for the integrated evaluation of urban transport system performance, incorporating operational, environmental, and social indicators into more comprehensive analytical frameworks. The second involves investigating the role of digital technologies, such as real-time monitoring systems, big data, and artificial intelligence, in improving the accuracy and reliability of performance measures used in fleet logistics management. The third possibility is to conduct comparative studies across different cities or urban transport systems, enabling the identification of performance patterns and best management practices applicable to diverse contexts. The advancement of these research lines could significantly improve public transport logistics management strategies and develop more efficient, sustainable, and population-oriented urban mobility systems.

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RSV
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DOI: 10.66104/znn1re84
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