

URBAN MOBILITY UNDER PRESSURE: A CRITICAL LOOK AT PUBLIC TRANSPORT IN NAIROBI'S METROPOLITAN AREA

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Purpose: This paper explores the critical challenges impeding the development of public transport services in the Nairobi Metropolitan Area. It aims to assess the current infrastructure, evaluate the role of governance, identify financial limitations, and propose sustainable transport strategies informed by global best practices.

Design/methodology/approach: The study employed a mixed-methods research design. Qualitative data were collected from comparative case studies of cities such as Bogota, and Shenzhen. Quantitative data were gathered via structured questionnaires distributed to commuters, transport operators, and regulatory authorities. Secondary sources included government reports, peer-reviewed literature, and environmental assessments.

Findings: The research reveals systemic weaknesses in Nairobi's transport system: poor roads and rail infrastructure, limited investment, informal and unregulated operations, and widespread corruption. These factors hinder service efficiency, sustainability, and safety. The findings highlight the urgent need for policy reforms, integrated infrastructure development, and public-private collaborations.

Originality/value: This study provides a comprehensive and localized analysis of the Nairobi metropolitan area public transport service sector, combining global insights with ground-level realities. It adds value by proposing practical, context-specific solutions for improving urban mobility in rapidly growing African cities.

Keywords: metropolitan, infrastructure, transport, population, urban, economy.

Category of the paper: Research paper.

1. Introduction

Public transport services are a cornerstone of urban mobility and development. The demand for effective, dependable, and inclusive transport services is critical in rapidly urbanizing regions like the Nairobi Metropolitan Area. Nairobi, Kenya's capital and East Africa's largest metropolis, experiences significant strain on its public transport services and infrastructure due to rapid population growth, urban sprawl, and governance challenges. According to

Macrotrends, Nairobi's population exceeded 5.5 million in 2024 and is projected to reach 10 million by 2030.

Year	Population	Growth Rate
2025	5,767,000	4.08%
2024	5,541,000	4.06%
2023	5,325,000	4.02%
2022	5,119,000	4.00%
2021	4,922,000	3.95%
2020	4,735,000	3.93%
2019	4,556,000	3.88%
2018	4,386,000	3.88%
2017	4,222,000	3.86%
2016	4,065,000	3.86%
2015	3,914,000	3.87%

Figure 1. Population growth in Nairobi over the years.

Source: Macrotrends database.

This trend of population growth in major cities is a phenomenon worldwide, and there is a need for a futuristic plan.

It is worth noting that a large proportion of this population is youthful and unemployed. The sample data indicates that 50% of respondents are unemployed, including both students and non-students.

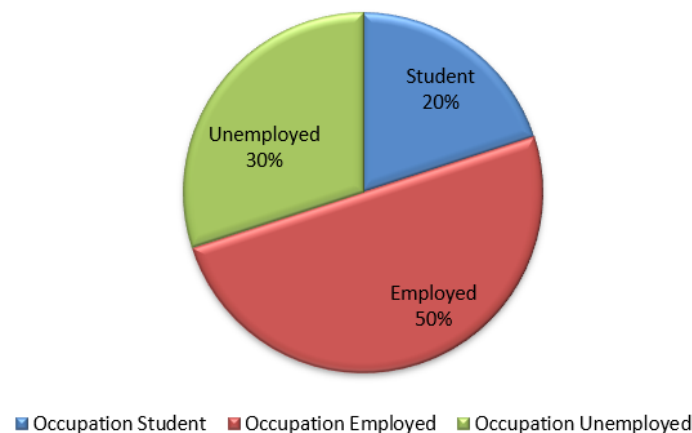


Figure 2. Occupation of people living within the Nairobi metropolitan area.

Source: Own study.

Notably, the unemployed place additional pressure on public amenities in the city without contributing to their sustainability and present a significant burden on the economy. The rapid population growth in this metropolis underscores the need for commensurate and sustained investment in transport systems. Challenges arising from poorly developed transport services and inadequate infrastructure often lead to acute traffic congestion, negative economic impacts,

and environmental degradation. The Nairobi Metropolitan Area, like other major metropolises around the world, requires modern, well-developed public transport services. Such improvements make it easier for residents to commute, thereby increasing socio-economic activity and reducing environmental impacts. A report by the Centers for Disease Control and Prevention (CDC) highlights that properly designed transport policies are critical in promoting public health by reducing traffic congestion, minimizing air pollution, and ensuring accessibility for its residents (CDC, 2024).

Similarly, according to Heaps, Abramsohn, and Skillen (2021), expanding public transport systems translates to a significantly enhanced public health and promoting social equity. These benefits include reducing traffic crashes, lowering pollution levels, encouraging physical activities, and improving access to essential services such as medical care, employment opportunities, nutritious food, and social connections.

Even though efforts have been made to improve public transportation in Nairobi metropolitan area, there are still many problems hindering development. This paper seeks to address systemic inefficiencies and proposes ideas for a more dependable, inclusive, and sustainable public transport system.

2. Literature review

Mobility is an essential element of social, economic, and individual life. Since the earliest societies, human existence has been inextricably linked to the need to move. Initially, people moved to find food and shelter, and to protect themselves from threats. As civilization developed over time, mobility became a key element of trade, communication, and general cultural exchange between communities. Today, mobility is an intrinsic part of people's lives as it enables access to work, education, healthcare, recreation, and many other areas.

In the context of urban transport, mobility describes the potential and actual movement of people and goods within a city. Potentially, it expresses the accessibility and reachability of a variety of destinations where different human needs can be met. From this perspective, mobility is an individual concept resulting from the spatial distribution of an area and the location of places for socializing, working, and other activities. This potential mobility is limited by factors such as time, budget, and the transport network's available means of transport. In practice, however, mobility is described by measures such as distance travelled per person in kilometers, travelled by different modes of transport, vehicles on a given stretch of road in each period, and transport workload (Meżyk, 2019).

The satisfaction of human mobility needs may be realized primarily through either collective or individual modes of transport. Collective transport refers to regular, scheduled services that are organized at the request of local governmental transport authorities and may operate within a single municipality or across multiple municipalities, based on inter-municipal agreements (Kiba-Janiak, Cheba, 2011). In contrast, individual transport is characterized by its non-scheduled nature, lack of regularity, and the predominance of private initiative and control (Kiba-Janiak, Cheba, 2011).

In scholarly discourse, collective transport is commonly equated with public or urban transport systems, whereas individual transport is typically associated with private means of mobility (Cichosz, 2014). Moreover, Cichosz (2014) identifies a third, intermediate category—group transport—which, although less prevalent, includes modalities such as taxis and carpooling.

The principal distinctions between the two primary transport categories—individual and collective—are summarized in Table 1.

Table 1.
Differences between individual and collective transport

Description	Collective transport	Individual transport
Source of funding	Dually: cities and users of this kind of transport	Users of this type of transport means
Regularity of transportation	High regularity of transportation	Lack or rare regularity of transportation
Transport conditions	Many people using one means of transport	A small number of people using the same means of transport
Costs	Low cost of movement for one passenger	Excessive costs of movement
Privacy	Lack of privacy	High privacy
House -to-house movement (flexibility of movement)	Moving along designated and fixed routes	You can reach any place

Source: Kramarz, Dohn, Przybylska, Jonek-Kowalska, 2022, p. 173; Kiba-Janiak, Cheba, 2011.

The previously indicated basic divisions of passenger transport in the city can be complemented by a classification indicating the following: surface transport (the most popular form of transport, e.g., bus, trolleybus, motorbike, urban railway), underground transport (underground railway), aboveground transport (monorail) and water transport (e.g. water tram) (Janczewski, 2020).

However, the applicability and effectiveness of these transport modes vary significantly across cities, particularly in developing regions. Urban mobility in many African cities is characterized by fragmented transport networks, heavy reliance on informal transport, and inadequate infrastructure (World Bank, 2022). In the Nairobi Metropolitan Area, rapid unplanned urbanization has created significant challenges for public transport systems. Aligula et al. (2005) highlight that Nairobi's transport system suffers from congestion, weak institutional coordination, and limited investment in mass transit solutions.

Studies also show that successful reforms in cities such as Bogotá and Shenzhen demonstrate how integrated transport policies, Bus Rapid Transit (BRT) systems, and electrification of public transport fleets can significantly improve mobility efficiency and environmental sustainability. However, despite these examples, Nairobi continues to face systemic challenges related to governance, financing, and infrastructure development. Therefore, further research is required to understand the specific structural barriers affecting the development of public transport in the Nairobi metropolitan area.

3. Methodology Research

This study adopts a mixed-methods research approach combining both qualitative and quantitative techniques to examine the challenges affecting public transport development in the Nairobi metropolitan area. The mixed-methods approach allows for the integration of statistical data with contextual insights from key stakeholders within the transport sector. Quantitative data were collected through structured questionnaires administered to commuters and transport services operators, while qualitative data were obtained through interviews with relevant stakeholders and comparative case studies of selected cities.

The subsections below describe the research design, data collection procedures, sampling strategy, and methods of data analysis applied in the study.

3.1. Research Design

The research adopts a mixed-methods research design that integrates both qualitative and quantitative techniques to develop a comprehensive understanding of the public transport challenges facing the Nairobi metropolitan area. The use of multiple data sources helped strengthen the reliability of the research. This approach is particularly appropriate for complex urban mobility studies, where both empirical measurements and institutional perspectives are required to explain transport system dynamics.

More so, this research design is both descriptive and analytical in nature. The descriptive component focuses on identifying the current state of transport infrastructure, operational efficiency, and commuter experiences. The analytical part investigates underlying governance and socio-economic factors influencing the development of public transport services in the metropolis.

3.2. Quantitative Data Collection

Quantitative data were collected through structured questionnaires distributed to 60 respondents within the Nairobi metropolitan area. The respondents included daily commuters, matatu operators, and representatives of transport authorities. The questionnaire

consisted primarily of closed-ended questions designed to capture commuter experiences and perceptions of the public transport system.

The survey addressed several key variables, including:

- occupation of respondents,
- transport mode distribution,
- infrastructure quality,
- perceived causes of congestion,
- exposure to bribery within the transport sector,
- approximate travel time of commuters,

Responses to these variables were analyzed using descriptive statistical methods to identify patterns in commuter behavior and perceptions, and to evaluate the key challenges influencing public transport usage and the effectiveness of existing mobility infrastructure in the Nairobi metropolitan area.

3.3. Qualitative Data Collection

Qualitative data were collected through document analysis of existing texts, including policy documents, reports, and relevant literature. This helped to examine underlying governance, financial, and institutional factors influencing public transport development. The qualitative component provided deeper insights into the systemic problems that cannot be fully captured through quantitative surveys alone.

3.4. Comparative Case Study Analysis

In providing additional context and identifying potential solutions, the study incorporated comparative case studies. It analyzes two international cities: Bogotá (Colombia) and Shenzhen (China). These cities were selected due to their globally recognized success in implementing innovative public transport systems. Firstly, Bogotá's Bus Rapid Transit (BRT) system demonstrates how high-capacity bus corridors can improve urban mobility and reduce congestion. Secondly, Shenzhen, through its large-scale electrification of public transport buses, represents a global example of sustainable mobility. These case studies provide useful insights and policy lessons that may apply to Nairobi metropolitan areas' transport development strategy.

3.5. Sampling Strategy

A purposive sampling method was used to select respondents who have direct experience with Nairobi's public transport system. This sampling strategy ensured that participants possessed relevant knowledge about Nairobi's transport sector. The selected participants included commuters who regularly use public transport services, operators involved in matatu operations, and stakeholders responsible for transport regulation and planning.

3.6. Data Analysis

Quantitative survey data were analyzed using descriptive statistical methods, including percentages and frequency distributions. These methods helped identify patterns in commuter perceptions and transport service performance.

Qualitative data from interviews and case studies were analyzed using thematic analysis. This involved identifying recurring themes related to governance challenges, infrastructure deficiencies, and financial constraints affecting public transport development.

3.7. Research Limitations

Despite the strengths of the mixed-methods approach, it is important to note that there can be limitations that should be acknowledged. For example, the sample size of respondents may limit the generalization of the results to the entire Nairobi metropolitan population. However, the integration of qualitative interviews and secondary data sources available helped enhance the robustness of the findings and provided valuable insights into the transport system that is currently in existence.

4. Existing transport services and infrastructure in Kenya

4.1. Mobility services available

Historically, transport in Kenya played a key role in socio-economic development, with early infrastructure shaped by colonial influence. In the 19th century, mobility was limited, relying on donkeys and horse carriages. These early routes influenced the current road network. With Nairobi's designation as the capital of British East Africa, formal transport infrastructure began to develop, including passenger buses such as Kenya Bus Services and rail tracks by Kenya Railways Corporation linking Nairobi to Mombasa, Kisumu, and Nakuru.

In the 1960s, the emergence of matatus—privately owned vans—introduced affordable, though initially illegal, public transport (Sclar, Alexander, 2007). Despite initial opposition, matatus were legalized in the 1980s and currently they dominate Nairobi's public transport service system. About 1 million people rely on matatus to commute daily (Salon, Gulyani, 2019). They operate alongside buses under SACCOs, as per Nairobi's city by-laws. Even though matatu operations are licensed, there is still an extensive unlicensed informal network in the metropolis.

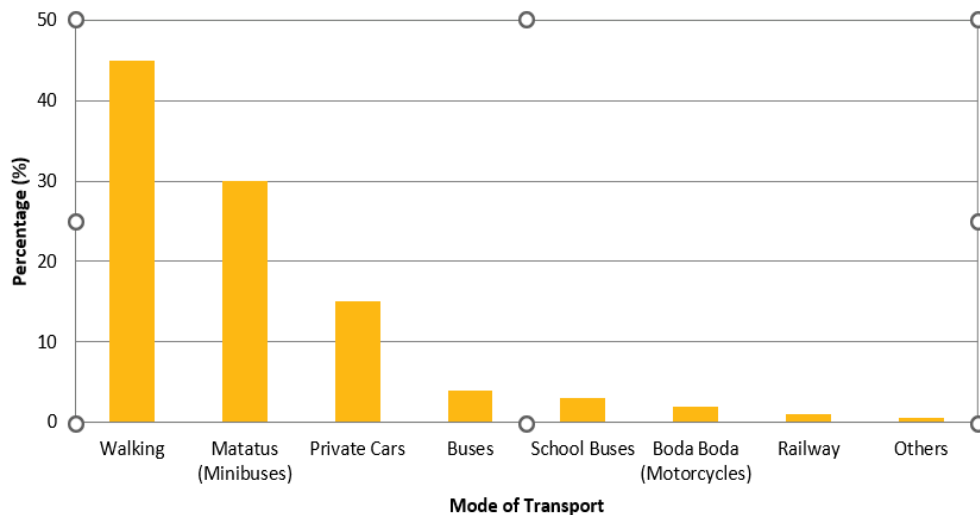


Figure 3. The distribution of the use of major means of transport in the Nairobi metropolitan area.

Source: Own study.

Research findings show mobility within the metropolis is highly dependent on walking and the use of matatus (minibuses). Visibly, the limited use of formal public transport options, such as buses and rail, points to inadequate investment and poor integration of mass transit systems. Additionally, the low reliance on private vehicles suggests economic constraints among residents.

4.2. Infrastructure present

Key infrastructure components include major roads that link Nairobi city to other urban centers and other roads link the CBD to its outskirts. Listed below are examples of major highways and bypasses, commuter terminals, railway networks parking zones and non-motorized infrastructure present:

Nairobi Expressway: A 27-km elevated toll highway linking CBD to Jomo Kenyatta International Airport, easing congestion, and reducing travel time to 20 minutes (South China Morning Post, 2022). It was completed in 2022 under a public-private partnership between the Kenyan government and China Roads and Bridges Corporation, costing approximately €487 million.

Thika Superhighway: Eight-lane highway connecting Nairobi CBD to Thika Town, enhancing access to Kiambu and Mount Kenya region (Kenya Roads Board, 2020).

Outer Ring Road: Links Eastlands to Thika Road and Mombasa Road, recently expanded (World Bank, 2019).

Southern Bypass: From Mombasa Road to Kikuyu via Langata, relieving inner-city congestion (Kenya Roads Board, 2020).

Northern Bypass: From Ruaka to Ruiru via Limuru and Thika Roads.

Eastern Bypass: Connects Embakasi to Ruiru, easing traffic in densely populated areas.

Western Bypass: 32-km highway linking Kikuyu to Ruaka, designed to divert traffic from CBD.

Bus Stations: Key terminals include Kencom, Odeon, Railways, Country Bus, Muthurwa, Afya Centre, Ambassadors, and Tea Room. Railway and Country Bus stations serve both local and long-distance routes. These hubs are crucial to the city's transport network, with modernization efforts needed to support a growing population. According to a study by Wangui (2017), matatus provide the biggest portion of public transport services in Nairobi, with key stations such as Kencom and Railways acting as the central nodes for these services. Similarly, a report by García (2022) highlights that bus stations are essential to city commuter transport. These findings underscore the need to modernize and expand the capacity of these stations to meet the growing urban population.

Nairobi Commuter Rail: Kenya Railways Corporation has revitalized existing colonial-era rail lines, using second-hand diesel trains from Spain's SFM to enhance urban mobility. Rail remains a preferred option along available routes due to cost and time savings (Simpson, Barry, 1994).

Non-Motorized Transport Infrastructure: Sidewalks and pedestrian footbridges support walking, which accounts for 47% of transport modal share. Bicycle lanes are being included in urban plans, though implementation remains limited.

Parking Facilities: Nairobi offers both public and private parking in malls, offices, and near public spaces like hospitals and markets. Designated zones for taxis also exist within the CBD.

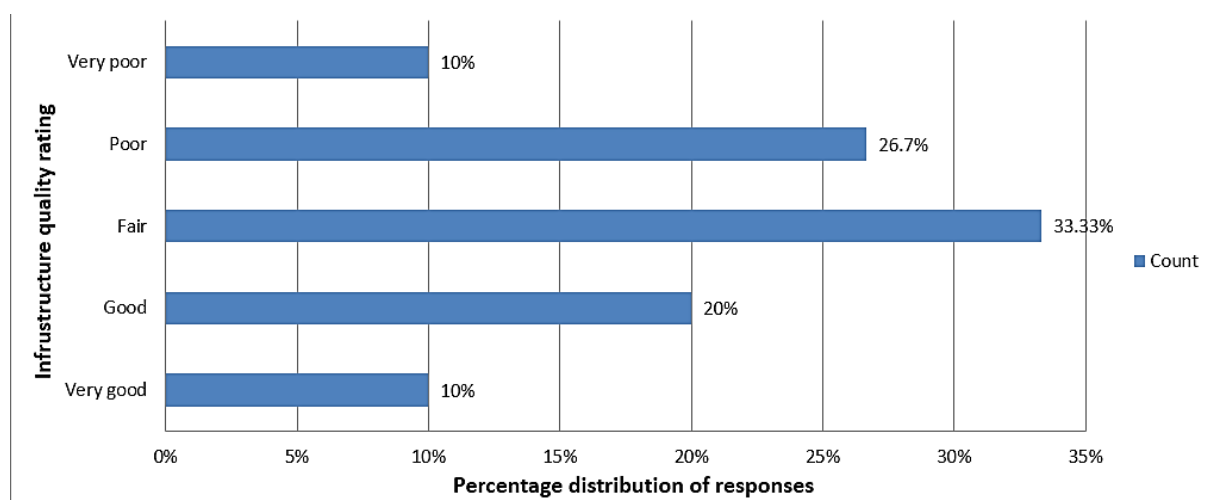


Figure 4. Resident's sentiments on the quality of infrastructure present in Nairobi.

Source: Own study.

The predominance of fair (33.33%) and poor (26.7%) ratings by the research findings indicates that existing infrastructure is insufficient to support dependable, safe, and efficient transport systems. This distribution suggests that a significant proportion of users experience persistent challenges in mobility, including delays, discomfort, and limited accessibility. It also reflects the poor quality of public transport delivery.

5. Challenges in public transport services development

The development of public transport in Nairobi faces critical challenges that compromise its efficiency and reliability. The challenges in the development of public transport services focus on systemic, operational, and societal barriers that hinder efficiency and reliability. These challenges include overcrowding due to high commuter volumes, unregulated matatu operations, and weak enforcement of traffic laws. Additionally, there is political interference, corruption, and resistance to change by commuters and operators that significantly impact the implementation of reforms.

5.1. Social challenges

Congestion and Overcrowding

The Nairobi metropolitan area is documented to host approximately 15,000 vehicles daily operating on approximately fifty routes, with 14-seater matatus comprising 80% of the total (Africa Snow, 2024). Matatus operators often compete for passengers, leading to erratic driving behaviors such as frequent stops and acceleration, causing a smooth traffic flow to be disrupted. Additionally, the rise in the number of private vehicle owners has increased traffic congestion, while outdated transport policies and insufficient road networks fail to keep pace with the city's rapid growth.

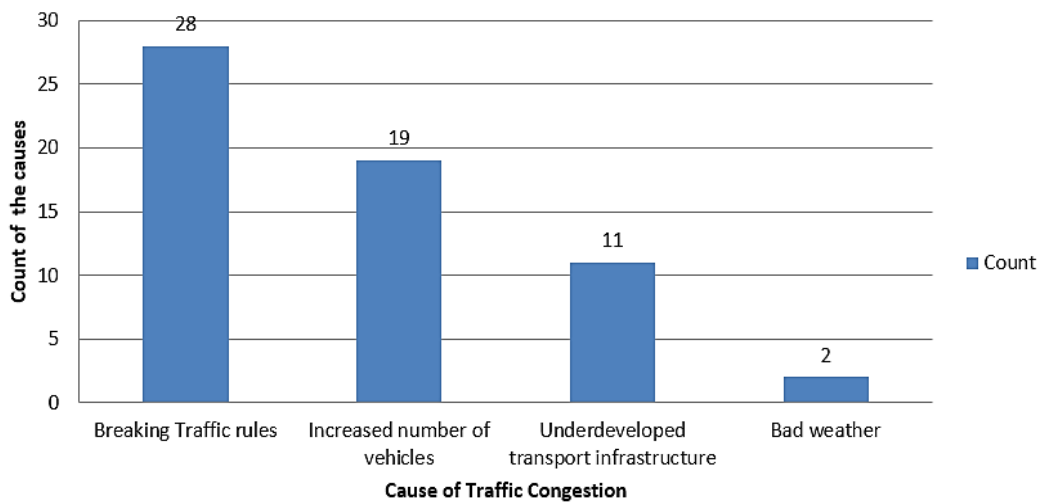


Figure 5. A representation of the causes of traffic congestion in the Nairobi metropolitan area.

Source: Own study.

Research findings indicate that traffic congestion in the Nairobi metropolitan area is largely driven by both behavioral and systemic factors. In particular, the prevalence of traffic rule violations as a major contributing factor, coupled with other challenges, exacerbates congestion and imposes a significant burden on commuters and residents.

Resistance to Change

Resistance to change by commuters and operators often results in opposition to the public transport initiative proposed by city management. Examples include opposition to relocating bus stations from the city center to facilities such as the Nairobi Green Park Terminal, which has led to riots and resistance. In this case transport operators resisted changes that restrict their access to the city center, whereas traders argue that such relocations harm their businesses. Commuters' express concerns about being dropped off at locations far from their destinations, which adds to opposition efforts. Many matatus are outdated, lacking modern safety and comfort features, and are operated under loosely regulated Savings and Credit Cooperative Organizations (SACCOs).

Informal transport service networks

According to Kinyanjui (2023), a substantial number of the matatus, buses, and termini are operated illegally. The report revealed that while 272 SACCOs were officially registered in Nairobi, an additional 420 unregistered SACCOs were operating illegally. This lack of regulatory oversight has allowed matatus to operate on unauthorized routes, contributing to disorder in the public transport sector. These services depict how Nairobi's public transport sector is highly informal, despite government attempts at regulating it and despite various attempts at organizing the actors into formal unions. Many matatu routes are infiltrated and controlled by the illegal gangs (Rasmussen,2012). These illegal operations contribute significantly to the disruption of traffic flow and pose significant safety risks to passengers and other road users.

Political Involvement

Nairobi being the capital of Kenya means that the metropolitan region is a crucial focal point of political activities. Firstly, politicians often avoid implementing reforms in the transport sector if such reforms conflict with the interests of matatu sector members, as they prioritize securing votes. Secondly, members of different ethnicities always clash and fight over routes and stages that lead to full-blown skirmishes, especially during elections. Efforts to relocate hawkers from streets often becomes difficult because of the political sensitivity associated with such moves (Oduor, 2024). Hawkers form a huge voting block that can be considered by any political aspirant within the metropolitan area. Therefore, political considerations, including winning the support of hawkers and the influence of organized groups, often complicate enforcement actions. According to (Mutai,2023) such politics contributes significantly to the obstacles faced by authorities in managing street vending activities within the city.

Bribery

Bribery extends to all transport stakeholders, including traffic police officers, drivers, and commuters. This results in poor law enforcement and compromised road safety. SACCOs, drivers, and conductors often pay advance bribes to regulatory officers to avoid arrest or fines, highlighting significant integrity issues within the sector. As shown in Figure 6 below, the likelihood of bribery occurring within the transport system is high, with up to 90% of respondents reporting that they have witnessed bribery taking place.

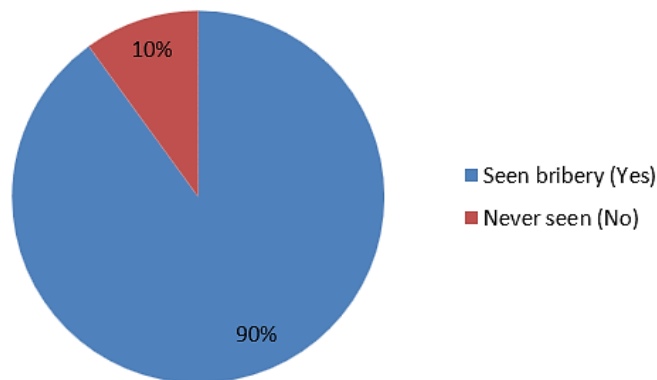


Figure 6. Bribery in the public transport services sector as witnessed by commuters.

Source: Own study.

The findings reveal that bribery is widely prevalent in the public transport sector, with a significant 90% of respondents reporting having witnessed such practices. From the responses given, it can be inferred that there are deep systemic governance and regulatory challenges in the Nairobi metropolitan area.

5.2. Infrastructure inadequacies

Inadequate infrastructure puts immense pressure on existing ones, hindering gradual progress towards a sustainable transportation system. According to a 2023 report by the Kenya Urban Roads Authority (KURA), shown in Table 2 below, of the 3982 kilometers of urban roads, 2385 kilometers are officially gazetted, while 1597 kilometers are classified but still awaiting gazettelement. However, conditions on these roads vary significantly, with 34% (1334 kilometers) considered in good condition, 43% (1704 kilometers) in fair condition, and 24% (943 kilometers) in poor condition. The report shows 1956 kilometers of urban road network remain unpaved, representing half of the total distance. This substantial proportion of unpaved and poorly maintained roads in urban centers increases the congestion and inefficiencies that already plague the transport system (KURA, 2023).

As a matter of urgency, the government needs to improve the 24%—equivalent to 943 km—of urban road networks that are currently in poor condition. Additionally, 49% of unpaved roads need to be upgraded to paved roads, as unpaved surfaces are often severely affected by weather conditions such as heavy rains.

Table 2.
Condition of Roads in Kenya's urban centers

Road Surface Type	Condition			Total (Kms)	Proportion (%)
	Good (Kms)	Fair (Kms)	Poor (Kms)		
Paved	858.21	839.9	327.81	2025.92	51%
Unpaved	475.80	865.00	615.28	1956.08	49%
Total	1334.01	1704.9	943.09	3982.00	100%
Proportion (%)	34%	43%	24%	100%	

Source: Kenya Urban Roads Authority's 2023 report.

The expansive Nairobi metropolitan area is faced with inadequate terminal facilities for buses and matatus. This further leads to the ineffectiveness of the transportation system that affects commuters. Most terminals are overcrowded with commuters, small-scale vendors, homeless people, etc. These terminals in most cases usually lack basic amenities such as waiting bays, proper lighting, and sanitation facilities.

Rail transport remains an underutilized infrastructure in the Nairobi Metropolitan Area. An efficient rail network could provide a sustainable solution to mass transit. However, according to Kenya Railways (2024), poorly maintained railway lines and inadequate stations continue to hinder the effectiveness of the commuter rail service, which also suffers from a shortage of passenger coaches and freight wagons. The railway network covers only a limited area, mainly because no new railway lines have been developed since Kenya's independence in 1963. The Nairobi Commuter Rail Service operates on tracks originally built during the British colonial era. Lack of expansion and connectivity restricts the rail system's potential as a viable mass transit solution, forcing many commuters to rely heavily on road transport.

Lastly, there is a lack of adequate non-motorized transport (NMT) infrastructure in Nairobi. Many streets in the city center and satellite towns do not have proper sidewalks. Where sidewalks do exist, they are often occupied by street vendors and hawkers, forcing pedestrians to share space with vehicles and significantly increasing the risk of accidents.

5.3. Financial Constraints

Several factors cause financial constraints in the development of public transport services in the Nairobi metropolitan area. Below are a few major causes:

5.3.1. *Insufficient Budgetary Allocations*

One of the key challenges facing public transport development in Nairobi is chronic underfunding by the government. Budget allocations are often inadequate to initiate, implement, or complete critical projects. Large-scale transport infrastructure like the Bus Rapid Transit (BRT) system requires substantial investment, yet it has struggled due to minimal government financial commitment. Nairobi's ambitious plans are regularly stalled or delayed

because city management cannot meet contractor payments or afford comprehensive project execution.

5.3.2. *Corruption*

Funds allocated for transport systems development are often misappropriated. Embezzlement and kickbacks between contractors and ministry officials are usually common. Contractors sometimes pay bribes to win tenders, inflate project costs, or abandon projects midway once money has been siphoned. Delays in the disbursement of funds, combined with governance challenges, usually force the suspension and abandonment of the projects. Bribery remains a pervasive daily phenomenon in Kenya's public transport sector. An example is the illegal payments made by public transport operators to traffic police or municipal officers to evade arrest for breaking the law or failing to pay required licenses. This system of bribery drains potential revenue and deters reforms. As a result, trust in institutions erodes, and the effectiveness of public service delivery is compromised.

5.3.3. *Weak Public-Private Partnership (PPP) Frameworks*

While PPP models have shown great success globally, Nairobi has struggled to attract private-sector involvement in transport infrastructure. This is due to:

- Unclear policy frameworks.
- Lack of investor protections.
- High perceived risks.
- Widespread corruption and political interference.

Private investors hesitate to engage in long-term transport projects where returns are uncertain, and the legal environment lacks predictability. The failure to streamline PPP laws and provide incentives for private sector involvement has significantly slowed the city's infrastructure development. Without reforms in governance and enforcement, PPPs remain underutilized as a tool to bridge funding gaps.

6. Implications and consequences

The availability of a seamless transport service system in cities is paramount to its development. However, poor development of transport services always results in frequent malfunctioning leading to adverse consequences. The implications affect not only the commuters but also the country's economy, environment, and sustainability of the sector. Urban mobility in Nairobi's metropolitan area is severely affected by multi-faceted persistent challenges. Examples include heavy traffic congestion and environmental pollution, which manifests itself as excessive noise, smoke, and dust. Additionally, limited route networks constrain accessibility for commuters (Aligula et al., 2005). These mobility issues are further

compounded by ineffective management practices, inadequate safety measures, and widespread insecurity within the public transport system. The implications are therefore major issues that must be addressed.

6.1. Urban sustainability

Urban sustainability in transport services refers to the sector's ability to meet the needs of commuters, function efficiently, and expand commensurately with the growing population without external interventions. To ensure this there is always a need for both infrastructural development and transport service improvements. According to Wang et al. (2018), transportation infrastructure significantly affects sustainable development, which in turn affects various environmental and economic factors. This highlights the government's need for the constant development of transport infrastructure. When infrastructure and services face development challenges, the sustainability of public transport system is critically compromised (Tucho, 2022). The results of an unsustainable transport service in Nairobi are:

1. Operational Inefficiency.
2. Increased Dependence on Informal Transport.

Operational Inefficiency

Insufficient investment in transport infrastructure leads to poor revenue generation, high operational costs, and inefficient service delivery. The dependence on outdated matatu fleets and poorly maintained roads increases maintenance expenses, which puts operators and commuters at risk. Furthermore, cash-based fare collection systems result in revenue leakages, limiting funds available for infrastructure upgrades and service improvements (Wang et al., 2018). The lack of strategic investments in public transport further hinders the system's ability to sustain itself financially, leading to continued inefficiencies (Tucho, 2022).

Increased Dependence on Informal Transport

Poor infrastructure development in the Nairobi metropolitan area forces commuters to rely on informal transport means of mobility such as unregistered matatus and boda-boda motorbikes, which are not only unsafe but also unreliable. The absence of an integrated transport network, which connects buses, commuter rail, and nonmotorized transport (NMT) routes, reduces efficiency, and magnifies congestion. Studies on urban transport challenges highlight that an overreliance on informal transport discourages structured private-sector investments, further complicating urban mobility planning and sustainability (Tucho, 2022). Without proper integration and long-term planning, Nairobi's transport system risks remaining fragmented, inefficient, and environmentally unsustainable.

6.2. Socio-economic implications

Due to the inadequate development of the commuter infrastructure, Nairobi faces an uphill task in addressing its economic and social challenges. Congestion in the metropolitan area usually makes the commute time longer than expected. During rush hours, for example, while going to work, a journey that would take less than 30 minutes often exceeds over 2 hours. A third of the productive time is wasted on the road and this situation is unfortunately repetitive for daily commuters. A report by The Standard, a local newspaper (2024) indicated that Nairobi lost Ksh 58 million daily (about \$ 448 thousand) in the estimated time wasted in traffic jams. Such losses have a significant influence on the economy, affecting job creation, employee paycheck management, and expansion of businesses. Furthermore, due to unethical drivers' behavior of flaunting traffic rules by speeding up and overlapping, Nairobi's transport sector is often plagued with accidents. This costs the economy not only a healthy workforce, but injured patients are a burden to the health system.

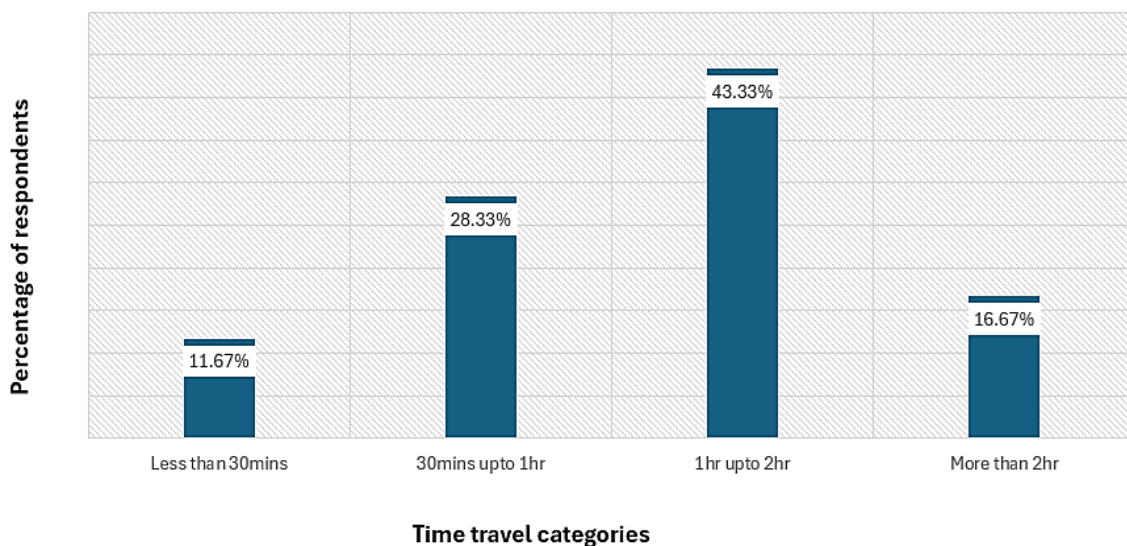


Figure 7. Commuter responses on the average time taken to travel from one area to another in Nairobi. Source: Own study.

Figure 7 above indicates that 43.33% of respondents spend between one and two hours traveling from one point to another. This reflects notable inefficiencies within Nairobi's transport system. This pattern clearly highlights the effects of congestion and infrastructural limitations, which contribute to prolonged travel times. As a result, commuters experience persistent mobility challenges, including delays and reduced travel reliability.

6.3. Environmental implications

The transport sector is a major contributor to environmental pollution not only in Kenya but also globally. Several forms of pollution are caused by this sector of the environment. These forms of pollution are intertwined, and in addition to the unwillingness to improve it can only increase. These forms of pollution are as follows:

- Air Pollution.
- Noise Pollution.
- Water and Land Pollution.
- Encroachment of Green Spaces.

6.3.1. *Air Pollution*

According to Statista, road transport is one of the largest producers of greenhouse gas (GHG) emitters. By 2021, road transport contributed to a total of 12% of these gases, making it the second largest contributor to global emissions after coal power. Furthermore, the study elaborates that the primary source of transportation emissions is light-duty vehicles, such as passenger cars (Statista Research Department, 2024). In Kenya, high vehicle emissions from old and poorly maintained public transport vehicles contribute significantly to air pollution.

The increase in the number of vehicles and the reliance on petrol-fueled matatus and buses in the public transport sector in Nairobi serves to only amplify the release of greenhouse gases. The high concentration of air pollutants, particularly particulate matter, is attributed to the large number of vehicles on the roads, deteriorating road conditions, and poor vehicle maintenance. The study highlights that these factors contribute significantly to air pollution, exacerbating its impact on public health and the environment (Wanjiku, 2023).

Traffic congestion further increases the environmental impact because vehicles idling in traffic emit pollutants longer. Air pollution is equally concerning, with dust from unpaved or deteriorated roads in Nairobi city and satellite towns adding to the pollution by particulate matter. During the dry seasons, fine dust is airborne and contributes to poor air quality. According to IQAir, the main contributors to PM_{2.5} pollution in Nairobi include vehicle emissions. Many vehicles, motorcycles, and trucks are older models, and emit higher levels of pollutants due to less efficient combustion processes (IQAIR,2025). Long-term exposure to PM_{2.5} there is an increase in the risk of people developing respiratory conditions such as asthma and bronchitis. The risk only increases further among vulnerable groups such as children and the elderly. (Kinney et al., 2011). In 2012, according to a report by the World Health Organization (WHO), air pollution-related diseases were responsible for approximately seven million premature deaths worldwide (World Health Organization, 2014).

6.3.2. *Noise pollution*

Due to traffic congestion, overcrowded bus stations, and narrow streets, drivers frequently honk while conductors shout to attract the attention of potential passengers. In addition, old vehicles, particularly buses and matatus, often play loud music and have revving engines, further contributing to noise pollution. This significantly disrupts urban life in the Nairobi Metropolitan Area, leading to increased levels of stress among residents.

6.3.3. *Water and Land Pollution*

Oil leaks and the improper disposal of vehicle maintenance waste significantly contribute to contamination of water bodies in the Nairobi Metropolitan Area, posing severe risks to aquatic ecosystems and public health. Many garages that serve matatus are located along riverbanks, where oils, paints, and other hazardous materials are often washed into the rivers during maintenance activities. These practices, combined with inadequate waste management systems, exacerbate pollution levels. The absence of stringent law enforcement allows such environmentally harmful practices to persist unchecked, further degrading water quality and threatening biodiversity. Notable examples are the Nairobi and Ngong rivers, which were once vital ecological resources but have become heavily polluted due to the careless disposal of toxic substances.

6.3.4. *Encroachment of green spaces*

The expansion of informal transport infrastructure often results in the encroachment of green spaces and public lands, leading to significant environmental consequences. Such encroachments reduce urban biodiversity and limit the natural absorption capacity of pollutants, exacerbating air and water pollution.

7. Recommendations

To address Nairobi's transport challenges, several solutions and interventions are recommended:

- Nairobi Metropolitan can construct a BRT system that will enhance fast and reliable transit services to its mass population. Example of a city that has implemented BRT systems is Bogota, Columbia. This city has shown that BRT systems can change the dynamics of commuter transport in populated cities. According to the Energy Sector Management Assistance Program (ESMAP) (2009), Bogotá's TransMilenio system has significantly reduced travel times by 32% overall and improved accessibility for millions of commuters, accident rates by 92%, fuel savings by 47%, and emission reduction by 40%.
- Due to global shifts to modern electric buses, Nairobi can take this early advantage and be among the first cities to gradually transition to electric buses from Matatus. However, there is a need to invest in clean energy infrastructure, such as charging stations. Cities like Shenzhen, China, have become global pioneers in adopting green transport solutions by transitioning to an entirely electric bus fleet. According to a case study by the International Energy Agency (IEA) authored by Berlin, Zhang, and Chen (2020), by 2017, Shenzhen was the first city in the world to successfully electrify approximately

17,000 of its buses. This transition has led to a significant reduction in greenhouse gas emissions.

- With the knowledge of Smart city solutions for mass transit, Nairobi can easily develop integrated mobility systems between different modes of transport. This can also be supported by the advancement of technology in mobile applications thereby taking advantage of unified ticketing systems and real-time information platforms.
- To easily decongest the city center, the management can introduce congestion fees in the city center. This will serve a dual purpose: reducing traffic in the city by discouraging private cars into the CBD and the city authority will earn revenue.
- There is a need for the expansion or construction of a well-organized bus and matatu termini with designated parking and boarding areas in the city and its satellite towns.
- Roads and streets should be expanded to eliminate bottlenecks that cause traffic congestion and vehicle interlocking.
- Solutions can also come from the implementation of technology-driven enforcement of traffic laws and route allocation to curb illegal operations and corruption.

Therefore, Nairobi city authorities should consider expanding non-motorized infrastructure. This will reduce overreliance on public transportation and alleviate strain on the transport system. An example is Copenhagen, Denmark, which is renowned for its extensive cycling infrastructure and pedestrian-friendly urban design. The city has achieved remarkable success, with 49% of all trips to work or school made by bicycle—up from 35% a decade ago. This progress is attributed to sustained municipal investment, with the city allocating more than €40 per capita annually to develop and maintain its cycling infrastructure (Thoem, n.d.).

8. Conclusions

According to a report by the United Nations, 55% of the world's population resides in urban areas, a figure projected to rise to 68% by 2050 (UN, 2018). This rapid urbanization is expected to place increasing pressure on public transport systems, as is already evident in the Nairobi Metropolitan area. The findings of this research study demonstrate that Nairobi's commuter transport system is facing serious challenges. The challenges are a result of a combination of issues, namely, infrastructural limitations, behavioral patterns, and systemic inefficiencies. All these contribute to congestion, extended travel times, and reduced service reliability.

The fact that a significant proportion of commuters experience prolonged travel durations or delays reflects the broader impact of congestion and inadequate infrastructure on daily mobility. These conditions not only affect individual commuters through time wastage and increased costs but also have wider implications for national productivity. As such,

the challenges facing Nairobi's transport system are comparable to those experienced in many other developing nations' cities.

It is therefore of critical importance to have a coordinated policy intervention focused on upgrading transport infrastructure, strengthening institutional capacity, and expanding integrated mass transit systems to meet growing urban demand. Drawing from global best practices and grounded in local research, the study emphasizes the importance of strategic reforms, sustained investment, and strong political commitment in transforming Nairobi's transport sector. A multi-stakeholder approach involving international partners, government agencies, private sector actors, and local communities is essential for ensuring the effective implementation and long-term sustainability of transport initiatives.

An improved public transport system has the potential to enhance commuter experience while supporting broader socio-economic development and generating positive externalities. Notably, a well-functioning transport sector contributes to improved public health by reducing stress, limiting exposure to pollution, and lowering the incidence of road-related accidents, thereby fostering a healthier and more productive population. Furthermore, given that the transport sector is a major contributor to environmental pollution, the development of efficient and sustainable transport systems significantly reduces emissions and promotes environmental sustainability. Globally, as cities strive to optimize transport systems' performance, the overall burden of environmental pollution can be significantly reduced.

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