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Abstract
The Kisumu County Integrated Development Plans identify tourism and transport as key drivers of economic growth. Efficient transport systems are essential for supporting urban and peri-urban development, yet infrastructure expansion often threatens delicate ecosystems. This study, conducted between January 2020 and June 2021, examined the role of the public transport sector in advancing sustainable ecotourism in Kisumu County, Kenya. Data were collected from 393 respondents, including traders, households, and transport operators, using stratified, purposive, random, and systematic sampling. Additional insights were gathered from 15 key informants and 6 focus group discussions. Quantitative and qualitative data were analyzed using SPSS and MS Excel, with ANOVA tests applied to determine variable relationships. Findings showed that 99% of respondents depended on public transport, with 64.3% using it daily—primarily traders and those in formal employment. A significant correlation (p=0.000) existed between occupation and frequency of transport use. Similarly, between public transport characteristics. Road transport dominated at 97%, with boda-boda (49%), matatus (21.5%), and tuk-tuks (14.3%) being the most common modes. Most respondents (76.1%) traveled 30–60 minutes to reach tourist destinations. Over 69% found public transport to attractions affordable, accessible, and safe, though only 46% reported reliable route information. Services for Persons with Disabilities were noted as inadequate. The study identified key actors in the public transport sector and their roles in ecotourism development. It concludes that sustainable ecotourism in Kisumu requires inclusive planning, enhanced transport infrastructure, and environmental considerations, with stakeholder engagement in the public transport sector being critical to successful implementation.

Introduction
Transport and tourism are critical enablers of sustainable development (Laitamaki et al., 2016). Kenya's Vision 2030 aims to transition the country into a middle-income, industrialised economy (Kula, 2019), while aligning with the Sustainable Development Goals (SDGs) (Lawrence, 2020). Transportation is vital for tourism growth (Musa & Ndawayo, 2011), yet its environmental impact is often overlooked. Public transport systems, in particular, play a pivotal role in shaping urban form, land use, and ecological health, making sustainable planning essential (GOK, 2017).

Since the 2010 constitutional reforms and adoption of a devolved governance system, rapid growth has been observed in Kenya's counties, especially in metropolitan areas such as Nairobi, Mombasa, Kisumu, Nakuru, Eldoret, and Thika (Shilaho, 2015). This accelerated urbanisation has brought challenges in infrastructure, land use, environmental conservation, and service delivery. The public

transport sector is one of the most visibly strained areas, with systems failing to keep pace with the region's growing population and spatial expansion (Ndatho, 2018).

Kisumu County, in particular, is undergoing significant urban and peri-urban transformation. While the county is making strides in infrastructure expansion and service delivery, development is often implemented without adequately integrating ecological considerations or long-term sustainability goals. This lack of integrated transport and environmental planning poses a critical challenge to how to simultaneously enhance mobility, ecological preservation, and inclusive economic development (ITDP & United Nations-Habitat, 2021; County Government of Kisumu (CGK), 2023). Addressing this requires a more holistic approach that aligns urban development with environmental stewardship and sustainable transport systems (Buro Happold, 2020; SymbioCity, 2019).

At the same time, Kisumu County has high potential for ecotourism, given its rich natural and cultural heritage, including wetlands, forests, Lake Victoria's shoreline, heritage sites like Kit Mikai, and wildlife reserves (Ong'anya, 2024a). Ecotourism can serve as both a revenue stream and a tool for conservation, benefiting local communities economically while promoting sustainable land use (Makomere, 2024; Chaudhary et al., 2022; Okeyo, 2015). However, these fragile ecosystems are increasingly threatened by unchecked urbanisation, transport expansion, and shifting land-use patterns (Ong'anya, 2024b).

Problem Statement: *Despite Kisumu County's ecological potential and tourism assets, the current approach to urban growth and public transport development is unsustainable, mainly due to poor integration with environmental preservation strategies. Public transport infrastructure is not only inadequate but also contributes to ecosystem degradation through pollution, land encroachment, and unregulated expansion. As a result, a growing conflict exists between the need for improved mobility and the imperative to conserve ecologically sensitive areas. The central problem is the absence of a coordinated strategy that links public transport development with ecotourism and environmental sustainability.*

A shift toward sustainable public transportation is necessary to reduce emissions, conserve biodiversity, and promote equitable access, particularly for marginalised communities (Chikengezha, 2020; Ranchordás, 2020). Efficient, environmentally sound public transport systems can reduce dependence on private vehicles, thus minimising pollution and greenhouse gas emissions (Profillidis et al., 2014). Moreover, infrastructure development can enhance economic competitiveness, attract investment, and support regional integration when aligned with sustainability goals (Jiang et al., 2016). This study examined and evaluated the role and impact of the public transport sector on sustainable ecotourism development in Kisumu County, Kenya, to inform future planning and development.

Materials and methods

The research aimed to understand the role of the public transport sector in promoting sustainable tourism development in Kisumu County. To this end, the nature, types, quality and characteristics of transport services used by visitors to various attractions, as well as the roles of sector actors operating within the study area, were examined.

Research design

The study used a descriptive research design to systematically capture and interpret current conditions without manipulating variables. This approach is ideal for understanding natural behaviours, opinions, and relationships (Creswell, 2014). It enabled the collection of quantifiable data from respondents in Kisumu County. The design supported objective analysis of existing patterns. Overall, it provided a clear understanding of the subject within its real-world context.

Study area

The study was conducted in Kisumu County, located in western Kenya, between longitudes 33°20'E and 35°20'E and latitudes 0°20'S and 0°50'S. It borders Homa Bay, Nandi, Kericho, Vihiga, and Siaya counties, and lies along Lake Victoria, the world's second-largest freshwater lake (CGK, 2023). The county covers 2,086 km² of land and 567 km² of water. Kisumu County has a population of 1,155,574 (KNBS, 2019) and is divided into seven constituencies: Kisumu East, Kisumu West, Kisumu Central, Seme, Nyando, Muhoroni, and Nyakach, with 35 wards. The region boasts a diverse landscape, comprising wetlands, plains, hills, and rivers (Okeyo, 2015). The county experiences an annual rainfall between 1,100 mm and 1,600 mm, with temperatures ranging from 14°C to 18°C in August-September and 27°C to 32°C in June-July (CGK, 2023). Economic activities encompass fishing, agriculture, industry, tourism, and transportation, supported by a growing service sector and robust infrastructure (Amata et al., 2020).

Study population

The target population was defined as all 1,155,574 persons in Kisumu County, as reported by the Kenya National Bureau of Statistics (2019) census.

Sample size and sampling

Krejcie and Morgan's (1970) formula was used to determine the sample size, which worked out to be 384 for a finite population drawn from all households in Kisumu County (Table 1). An anticipated non-response rate of 10% was added to the sample size to achieve the required sample size, totalling 422 respondents.

The distribution ratio of the number of households sampled within the seven sub-counties and their respective wards was determined using the formula:

$$N_i = X\left(\frac{h_i}{H}\right)$$ ……..Equation 1

Where;

N_i =total number of households sampled per sub-county

h_i = population of households in the sub-county

H = target population (sample frame)

X = is constant (sample size = 422)

Using this proportional allocation method, a total of 422 respondents were proportionally sampled from the seven sub-counties in Kisumu County, based on their household populations. Kisumu East contributed the highest number (84), followed by Kisumu Central and Kisumu West with 63 each. Nyando, Muhoroni, and Nyakach contributed 58, 56, and 54, respectively, while Seme had the least with 44 respondents. This ensured fair representation across all sub-counties.

Purposive sampling was used for key informant interviews and focus group discussions (FGDs) to validate the household findings. Other samples were drawn randomly from respondents in locations that subtend unique ecosystems, natural features, historical attractions, geological and touristic phenomena, along major transport corridors or transit hubs within the County. The study drew insights from Shaw and Williams' (2002) categorisation to identify areas with ecotourism potential.

Data collection

The research focused on assessing the nature, types, and quality of transport services accessed by tourists. It explored the roles of various stakeholders in both the transport and tourism sectors in Kisumu County. It examined stakeholder roles and planning challenges in integrating public

transport with ecotourism. A mixed approach was employed, utilising surveys, interviews, observations, geospatial imagery, and secondary sources to assess transport quality and map ecotourism hotspots. A review of current and historical development plans provided context and comparative insights.

Data analysis

Quantitative data was analysed descriptively and inferentially. Qualitative data from open-ended questionnaire responses, key informant interviews (KIIs), and focus group discussions (FGDs) were analysed using thematic coding. Responses were read and grouped into key themes, each of which was assigned a numerical or binary code. Coded data were then entered into SPSS for analysis. Frequencies and cross-tabulations were used to examine the distribution of themes and their associations with other variables. This process enabled structured analysis of qualitative data within a quantitative framework.

Ethical considerations

The study adhered to ethical standards by obtaining informed consent, ensuring voluntary participation, and maintaining confidentiality. Approval was secured from relevant authorities, including the National Commission for Science, Technology, and Innovation (Nacotsi), to safeguard the rights of participants. All procedures respected individual dignity and cultural sensitivity.

Results

Demographic characteristics

The study achieved a response rate of 93.2%, with 393 respondents, and a male-to-female ratio of 59% to 41%. Most respondents (68.2%) were aged between 21 and 41 years, and 49.2% were natives of Kisumu County. Additionally, 69.5% of the participants were married, and 66% had at least a secondary education, with more females than males achieving a university education. The primary occupations were trade (30.1%) and transport (21.1%), with significant gender differences: males dominated the transport sector, while females were more active in trade.

Frequency of use of public transport

Respondents were asked how often they utilised public transportation to visit their favourite tourist or recreation spots. A majority of the respondents (64.3%) indicated they use public transportation daily. This was followed by 19.4% who stated they used public transportation several times each week. 6.5% reported using it at least once a week. Some 8.8% reported using available public transportation to get to the attractions several times a month. Only 1% of those who visited the attractions never utilised any form of public transportation. Further analysis revealed that the majority of respondents, regardless of gender, indicated that they use public transport daily. This was reflected by 42.6% of men and 21.7% of women. The majority of those who use public transportation several times a month were female (5.9%), while males accounted for 2.8%.

Mode of Transport Used by Respondents

The study indicated that the road is the preferred mode of transport, as reported by 97% of the respondents. The other 3% stated they preferred to access the attractions by water. Kisumu hosts an international airport approximately 6 kilometres from the city's Central Business District, which none of the respondents used. However, it is essential to note that some attractions are accessible or observable by using light aircraft, preferably helicopters, but are often considered expensive and unaffordable to many.

Means of Transport Used by Respondents

Results presented in Table 1 below reveal that the most preferred means of transport, as reported by the respondents, were motorcycles ('boda-boda'), minibuses or vans ('matatus'), and auto-rickshaws ('tuk-tuks'), representing 49%, 21.5%, and 14.3%, respectively. This was also noted in relation to

gender, as well as differences among sector workers and respondents within their respective occupations. The study found that there was occasional use of boats (3%), hired taxis (1.4%) and bicycle transport, also known locally as 'gware', at 1.9%. Some 6.6% preferred to use private vehicles, while 2.2% walked to the attractions, especially those nearby.

The majority of motorcycle users are male (31.4%), while females account for 17.6%. Other modes, such as bicycles, taxis, and private vehicles, are less frequently used, with low percentages across both genders. A Pearson correlation analysis was conducted to evaluate the relationship between the frequency of use of public transport to attractions and the occupation of the respondents, suggesting a highly significant difference (p = 0.001) between the two variables.

Table 1: Cross Tabulation of Public Transport Usage, Occupation and Gender

Means	Occupation						Sex		Total
	None	*Farmer*	*Transport*	*Formal Employment*	*Jua kali Artisan*	*Trader*	*Male*	*Female*	
Motor cycle	14 (3.9)	20 (5.5)	45 (12.4)	29 (8)	18 (5)	52 (14.3)	114 (31.4)	64 (17.6)	178 (49)
Matatu	13 (3.6)	7 (1.9)	13 (3.6)	8 (2.2)	8 (2.2)	29 (8)	39 (10.7)	39 (10.7)	78 (21.5)
Tuk-tuk	4 (1.1)	4 (1.1)	9 (2.5)	14 (3.9)	7 (1.9)	14 (3.9)	28 (7.7)	24 (6.6)	52 (14.3)
Private V.	4 (1.1)	3 (0.8)	4 (1.1)	3 (0.8)	2 (0.6)	8 (2.2)	13 (3.6)	11 (3)	24 (6.6)
Boat	3 (0.8)	4 (1.1)	0 (0.0)	3 (0.8)	1 (0.3)	0 (0.0)	3 (0.8)	8 (2.2)	11 (3)
Foot	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.3)	3 (0.8)	4 (1.1)	7 (1.9)	1 (0.3)	8 (2.2)
Bicycle	0 (0.0)	0 (0.0)	2 (0.6)	1 (0.3)	1 (0.3)	3 (0.8)	5 (1.3)	2 (0.6)	7 (1.9)
Taxi	0 (0.0)	0 (0.0)	1 (0.3)	0 (0.0)	2 (0.6)	2 (0.6)	3 (0.8)	2 (0.6)	5 (1.4)
Total (%)	38 (*10.5*)	38 (*10.5*)	74 (*20.4*)	59 (*16.3*)	42 (*11.6*)	112 (*30.9*)	212 (*54.4*)	151 (*45.6*)	363 (100)

Characteristics and quality of the public transport systems in Kisumu County

The public transport systems and services within the study area were assessed based on several criteria, including time, cost, reliability, accessibility, convenience, safety, comfort, availability, maintenance, inclusivity (for persons with disabilities), and customer service. The analysis of key travel indicators highlights a diverse range of user experiences in accessing the attraction, as indicated in Table 2 below.

Table 2: Characteristics and quality of the public transport systems in Kisumu

Indicator	Response Category	Percentage (%)
Time to Attraction	Less than 30 minutes	28.9%
	45 minutes	47.5%
	90 minutes	20.6%
	3 hours or more	3.0%
Cost of Travel	Less than Ksh. 50	15.8%
	Ksh. 50–100	46.1%
	Ksh. 100–300	33.6%
	More than Ksh. 300	4.5%
Reliability	Reliable	69.8%
	Slightly reliable	22.2%
	Unreliable	8%
Accessibility	Accessible	80.0%
	Slightly accessible	15.1%
	Inaccessible	4.9%
Convenience	Convenient	74.9%
	Somewhat convenient	18.1%
	Not convenient	7.0%
Comfort	Comfortable	69.7%
	Somewhat comfortable	23.0%
	Not comfortable	7.3%

Nearly half of the respondents (47.5%) reported an average travel time of 45 minutes to their destination. Another 28.9% indicated a shorter duration of less than 30 minutes, while 20.6% required up to 90 minutes. Only 3.0% experienced significantly longer travel times of three hours or more. In terms of cost, 46.1% of travellers spent between Ksh. 50 and Ksh. 100, followed by 33.6% who paid Ksh. 100–300. A smaller group (15.8%) spent less than Ksh. 50, while only 4.5% incurred expenses over Ksh. 300.

A majority (69.8%) described the transport system as reliable, with 22.2% finding it slightly reliable and 8.0% deeming it unreliable. On accessibility, 80.0% found the attraction accessible, 15.1% considered it somewhat accessible, and 4.9% found it inaccessible. Similarly, 74.9% rated access as convenient, while 18.1% and 7.0% believed it somewhat convenient and not convenient, respectively.

Passenger comfort was affirmed by 69.7% of respondents, while 23.0% rated it as somewhat comfortable, and 7.3% as not comfortable. Safety was another key area: 77.6% considered public transport safe, 15.7% said it was somewhat secure, and 6.8% perceived it as unsafe. Both male and female respondents generally expressed confidence in safety, although key informants raised concerns about occasional insecurity and accidents involving motorcycles.

In terms of vehicle condition, 74% believed public transport vehicles are well maintained, while 26.3% found them dilapidated. Regarding provisions for persons with disabilities (PWDs), 74.5% reported a lack of comfort or facilities, whereas 25% observed some level of comfort. Customer service received favourable feedback, with 63.8% rating it as generally good, 31.6% rating it as neutral, and 4.6% dissatisfied. A significant 46% noted that transport information is available but undocumented, 28% found it inaccurate or scanty, and 26% reported a complete lack of travel information.

Correlations between Public Transport Characteristics

Further analysis was conducted to establish the relationship between the various characteristics that determine the quality of public transport systems. These included reliability, access, convenience, safety and comfort. A 2-tailed Pearson Correlation test revealed a significant positive relationship between the characteristics of public transport used and the attractions, as demonstrated in Table 3 below.

Table 3: Correlations between characteristics of Public Transport

Correlations between characteristics of Public Transport

		Reliability	*Accessibility*	*Convenience*	*Safety*	*Comfort*
Reliability	Pearson Correlation	1	.760**	.678**	.619**	.604**
	Sig. (2-tailed)		0	0	0	0
	N	361	361	361	360	361
Accessibility	Pearson Correlation	.760**	1	.785**	.693**	.640**
	Sig. (2-tailed)	0.00		0	0	0
	N	361	370	370	369	370
Convenience	Pearson Correlation	.678**	.785**	1	.742**	.725**
	Sig. (2-tailed)	0	0		0	0
	N	361	370	370	369	370
Safety	Pearson Correlation	.619**	.693**	.742**	1	.800**
	Sig. (2-tailed)	0	0	0		0
	N	360	369	369	369	369
Comfort	Pearson Correlation	.604**	.640**	.725**	.800**	1
	Sig. (2-tailed)	0	0	0	0	
	N	361	370	370	369	370

Results indicated that there are strong positive correlations between all these variables between reliability and accessibility of public transport ($r = 0.760$, $p < .01$), accessibility (($r = 0.760$, $p < .01$), convenience ($r = 0.678$, $p < .01$), safety ($r = 0.619$, $p < .01$) and comfort ($r = 0.604$, $p < .01$). Similarly, accessibility is highly correlated with convenience ($r = 0.785$, $p < .01$), safety ($r = 0.693$, $p < .01$) and comfort ($r = 0.604$, $p < .01$). Convenience also shows strong correlations with safety ($r = 0.742$, $p < .01$) and comfort ($r = 0.725$, $p < .01$), while safety is most strongly correlated with comfort $r = 0.800$, $p < .01$). All correlations are statistically significant, as indicated by the p-values.

Discussion

This study examined the role of public transport in promoting sustainable tourism development within Kisumu County by investigating various transport modes, quality, user characteristics, and stakeholder roles involved. Kisumu's geographical position allows multiple modes of access to its tourism sites through road, water, and air. National statistics (KNBS, 2019) and local government reports (CGK, 2023) confirm that road transport is the primary mode of daily mobility for various purposes, including tourism, trade, and recreation. This is reflected in the study's sample, where 97% of respondents preferred road transport, with boda bodas, matatus, and tuk-tuks being the most frequently used means of transport. Gender and occupational trends further underscore this pattern, as males predominantly utilise motorcycles (31.4%), while females are more engaged in trade and use other transport means with slightly lower frequency.

Most of Kisumu's key tourist attractions are located within a 50-kilometre radius of the CBD. They are typically accessible within 30 to 60 minutes by road, a fact reflected in the travel time data, where nearly half of the respondents (47.5%) reported an average travel time of 45 minutes to sites. This relative proximity encourages the daily use of public transport, which 64.3% of respondents confirmed, with a slightly higher daily usage rate among men (42.6%) compared to women (21.7%). The predominance of short-distance, road-based mobility aligns with global findings that motor vehicles constitute about 77% of tourism trips, primarily due to their convenience, flexibility, and affordability (Rodrigue, 2020).

The preference for road transport in Kisumu also reflects broader themes linking public transport to local economic stimulation, as travellers access ancillary services such as food outlets and accommodation along main routes (Mutiso & Behrens, 2011; Olawo et al., 2014). The occasional use of water transport (3%) and negligible use of air transport among respondents highlight the localised nature of daily tourism mobility and the economic barriers to more costly options, such as aircraft charters. This further confirms that an elaborate and accessible public transport network, especially via road, is critical for enhancing ecotourism development as emphasised by Bokhari (2020), Gutiérrez and Miravet (2016), and Hall et al. (2017).

The study also identified a statistically significant correlation ($p = 0.001$) between occupation and the frequency of public transport use, emphasising how employment status influences transport patterns. Given that trade (30.1%) and transport (21.1%) constitute the largest occupational groups, with distinct gender distributions, the transport system not only serves tourism but also supports local livelihoods and commerce. These results align with the notion that public transport usage is influenced by socioeconomic and demographic factors, including employment, which must be considered when planning sustainable mobility solutions (Clarke, 2012).

The study reinforces Clarke's (2012) insight on gender dynamics, that transport systems are not gender-neutral, as evidenced by the differential use of transport modes and frequency by men and women in Kisumu. Despite the critical role of women in trade and secondary education attainment, they use public transport less frequently daily than men, suggesting varying travel needs and constraints that merit further investigation, particularly in urban African contexts where data remains scarce.

The quality and characteristics of Kisumu's public transport system also emerge as vital to user preference and tourism engagement. The majority of respondents rated transport reliability (69.8%), accessibility (80.0%), convenience (74.9%), safety (77.6%), and comfort (69.7%) positively, though concerns remain around vehicle maintenance (26.3% reported dilapidated vehicles) and inclusivity for persons with disabilities (74.5% reported inadequate facilities). These findings align with global research that highlights service quality as a key determinant of public transport attractiveness (Zhang et al., 2022; Göransson & Andersson, 2023). The strong positive correlations found among reliability, accessibility, convenience, safety, and comfort in this study (all $p < .01$) further confirm that improvements in any of these aspects tend to enhance overall transport system performance and traveller satisfaction, which ultimately influence ecotourism patterns in Kisumu.

The study's stakeholder analysis revealed a robust network comprising national and county government agencies, civil society, private sector players, tour operators, and local community groups. These actors collectively contribute to tourism product development, infrastructure, policy implementation, and capacity building, consistent with the findings of Okeyo (2015), Lelloltery et al. (2021), and Diamantis (2018). The active involvement of local communities, recognised as critical players in ecotourism by Manyara and Ndivo (2015) and Zhang and Lei (2012), is particularly significant in Kisumu, where linking economic benefits to conservation efforts within protected areas fosters sustainable tourism growth and community empowerment (Noll et al., 2019). Equally,

engaging public transport stakeholders in planning and development processes is essential to ensure that transport infrastructure and services effectively support sustainable tourism goals and equitable economic benefits within the county.

Policy Implications

The findings of this study offer several policy-relevant insights. First, local governments should prioritise the development and maintenance of reliable, affordable, and inclusive road transport systems to support tourism and economic participation, especially given the high daily use and reliance on boda bodas, matatus, and tuk-tuks. Second, targeted interventions to address gender-based disparities in transport access and usage should be developed, especially in areas where women play a leading role in trade but face mobility constraints. Third, infrastructure upgrades should include enhanced safety features and disability-friendly transport options to improve inclusivity and service quality. Fourth, accurate and accessible transport information systems should be established to guide both residents and tourists. Finally, the integration of tourism planning with transport development, supported by multi-stakeholder collaboration, should be institutionalised through county policy frameworks. This would ensure that transport systems contribute not only to mobility but also to broader goals of ecotourism, local economic development, and environmental conservation.

Conclusion

The findings indicate that public transport plays a key role in facilitating sustainable ecotourism in Kisumu County, as evidenced by the high usage rates among tourists visiting local attractions. A majority of respondents use public transportation daily, with road transport being the most prevalent mode. This preference is likely due to the county's accessible road network and the proximity of many tourist sites within a 50 km radius. Moreover, motorcycles, minibuses and auto-rickshaws are the most commonly used means of transport. The gender analysis also reveals that males are more likely to use public transport daily compared to females.

Furthermore, the study found that the quality of public transport services is influenced by key factors, including reliability, accessibility, convenience, and comfort, which are crucial in determining tourists' satisfaction. The five key characteristics of public transport —reliability, accessibility, convenience, safety, and comfort — showed that there are strong positive correlations between all these variables. Despite these positive assessments, areas for improvement were noted, particularly in vehicle maintenance, provisions for persons with disabilities and the accuracy of transport information. Based on the findings, the study recommends that transport development agencies should take into consideration the characteristics as well as the factors influencing the choice of public transportation when designing and developing public transport infrastructure, as they are necessary for ecotourism circuit development.

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