
Green Transportation and Airline Performance in Kenya

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Abstract:

Purpose: The study aimed to examine the effects of green transport on the performance of airlines in Kenya, addressing a critical gap by providing context-specific empirical evidence.

Methodology: The study was grounded in the Natural Resource-Based View (NRBV) of the firm and employed an explanatory research design. The target population included 260 departmental heads in procurement, marketing, human resources, and logistics across 65 airlines (40 passenger and 25 cargo airlines) operating in Kenya. A stratified random sampling technique was used to select 224 respondents from 56 airlines. Primary data were collected through structured questionnaires. Validity was ensured through face, content, and construct validity procedures, while reliability was evaluated using Cronbach's Alpha coefficient. Data analysis involved descriptive statistics (means, standard deviations, frequencies, percentages) and inferential statistics, including Pearson correlation and multiple regression analysis.

Findings: The regression analysis revealed that green transportation had a statistically significant and positive influence on airline performance in Kenya ($\beta = 0.403$, $p = 0.000$). The adoption of sustainable transport practices was positively associated with improved operational efficiency and performance outcomes.

Conclusion: The study concluded that green transportation practices are critical for enhancing the performance of airlines in Kenya. These practices contribute to cost efficiency, environmental sustainability, and competitive advantage.

Value: The study provides actionable insights for airline management and policymakers. It recommends prioritizing sustainable transport initiatives such as investment in fuel-efficient aircraft, optimization of flight routes, and implementation of carbon emission reduction programs. These initiatives can foster environmentally responsible operations and long-term financial performance in the aviation industry.

Keywords: Green Transport, Performance, Airlines, Carbon Emission

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1. Introduction

Airline performance is a critical indicator of the aviation industry's efficiency, profitability, and service quality. High-performing airlines prioritize safety, customer satisfaction, punctuality, and financial stability—all crucial elements in a highly competitive global market (Ali et al., 2024; Bamidele et al., 2023). Beyond operational success, airlines are increasingly evaluated on their capacity to balance financial growth with environmental responsibility (Kaffash et al., 2024). As climate change concerns escalate, stakeholders, including governments, customers, and investors, are demanding that airlines integrate sustainable practices to minimize their environmental footprint while maintaining competitiveness.

Green transportation practices such as adopting fuel-efficient technologies, investing in carbon offset programs, and optimizing flight operations—play a critical role in improving airline performance. These initiatives enhance environmental responsibility, which directly boosts customer loyalty, strengthens regulatory compliance, and attracts eco-conscious investors (Hermelingmeier & von Wirth, 2021). Scholars emphasize that green transportation not only elevates airlines' reputations but also fosters a sustainable aviation ecosystem, ensuring long-term profitability. By integrating sustainability into their decision-making, airlines can enhance their competitive edge while contributing to global climate targets.

Globally, the aviation industry contributes about 2.5% of CO₂ emissions and 3.5% of climate impact due to altitude-related effects (Ritchie, 2024). Airlines have therefore adopted sustainability initiatives, including eco-efficient fleet upgrades, waste reduction strategies, and renewable energy use, to balance growth with climate goals (Chen et al., 2021). In Africa, governments and companies are increasingly promoting environmentally conscious strategies, though adoption levels differ across sectors (Ahakwa et al., 2021). In Kenya, airlines face challenges including stiff international competition, high fuel costs, limited resources, and environmental concerns (Farah et al., 2018). Despite these hurdles, green transportation practices remain underexplored in Kenyan aviation compared to other industries such as tea and manufacturing, where sustainable practices have shown significant performance gains (Afande, 2015; Nzomo et al., 2023).

Although sustainability initiatives in transportation are growing globally, research linking green transportation practices to airline performance in Kenya is limited and fragmented (Kimathi, 2024; Manyala & Mberia, 2021). Existing studies often focus on financial or operational challenges while overlooking the role of green transportation in enhancing competitiveness, resilience, and sustainability. This gap is critical given Kenya's strategic position as a regional air transport hub and the increasing pressure for airlines to adopt eco-friendly operations. A comprehensive assessment of how green transportation practices influence airline performance in Kenya therefore provides valuable insights for managers, policymakers, and stakeholders seeking to enhance both sustainability and competitiveness in the aviation sector.

2. Theoretical and Empirical Review

2.1. *Natural Resource-Based View*

The Natural Resource-Based View (NRBV) of the firm, developed by Hart (1995), has become a key theoretical lens for understanding environmentally responsible operations (Chicksand et al., 2012). The theory emphasizes the strategic importance of resources and capabilities that

not only drive competitiveness but also contribute to ecological sustainability. Initially criticized for overlooking certain environmental complexities (Johnson-Hall, 2022), the NRBV has since been refined to highlight capabilities that directly support environmental stewardship and sustainable growth. By integrating conservation principles into organizational strategies, the NRBV provides a framework for achieving long-term competitive advantage through environmentally sustainable practices. Scholars argue that this theoretical approach is particularly valuable for industries like aviation, where environmental concerns are central, as it demonstrates how adopting green initiatives enhances economic, operational, and reputational performance (Vachon et al., 2008; Ashby, 2018).

Within the NRBV framework, green transportation practices are conceptualized as strategic resources that help organizations simultaneously meet environmental and market demands. These practices include fuel-efficient technologies, optimized route planning, carbon offset programs, and other initiatives that reduce environmental harm while improving operational efficiency. The NRBV explains why firms in the same industry often adopt different levels of environmental practices, despite facing similar external pressures (Laari, 2016). In the context of Kenya's airline industry, green transportation practices can strengthen competitiveness by aligning operational strategies with sustainability goals, reducing resource inefficiencies, and appealing to environmentally conscious stakeholders. As such, the NRBV provides a strong foundation for analyzing how green transportation practices enhance both the sustainability and performance of airlines.

2.2. Empirical Review (hypothesis development)

Several studies in Africa demonstrate that green transportation practices have a strong link to firm performance. Ali et al. (2024) found that Nigerian oil and gas firms adopting fuel-efficient vehicles reported improved service quality, customer satisfaction, and retention. Similarly, Isoghom and Daminabo (2024) established that road transport companies in Nigeria experienced enhanced environmental, social, and economic outcomes when eco-driving and efficient routing were implemented. In Kenya, Mutua et al. (2020) confirmed that green supply chain practices, including green transportation, significantly improved firm performance, partly through economic gains. Likewise, Kanyepe et al. (2023) reported that green transportation positively influenced operational efficiency in Zimbabwe's freight sector, particularly when supported by strong management commitment. Collectively, these studies suggest that green transportation adoption strengthens competitiveness and sustainability across diverse African industries.

Although many studies highlight the positive effects of green transportation, findings are not universally consistent. Mlambo et al. (2024), studying South African trucking firms, discovered that advanced green transportation technologies initially reduced operational performance. The high capital costs of telematics, fuel-efficient, or electric trucks created financial strain, particularly for smaller firms. This evidence suggests that while green transportation enhances long-term sustainability, it may create short-term trade-offs in efficiency and profitability. This nuanced finding emphasizes that the impact of green transportation practices can depend on firm resources, scale of investment, and contextual economic conditions.

Beyond Africa, studies in Asia and globally provide further support for the strategic role of green transportation. Danial and Rahmat (2024) found that Malaysian logistics firms achieved significant improvements in financial, environmental, and social performance when adopting

eco-friendly transport. Globally, Lu et al. (2019) developed an Environmental Logistics Performance Index (ELPI), showing a strong correlation between countries' logistics efficiency and environmental transportation performance. Shouket (2019) in Pakistan and Rehman et al. (2023) across energy transition economies confirmed that green transportation mitigates environmental degradation, though urbanization and trade liberalization remain challenges. These studies reinforce that green transportation is essential for both firm competitiveness and environmental conservation.

In the aviation context, Janic (2018) explored alternative fuels such as Synthetic Paraffinic Kerosene (SPK) and Liquid Hydrogen (LH2), showing that while SPK achieves modest emission reductions, LH2 could dramatically lower aviation-related carbon emissions. Together, empirical evidence across sectors demonstrates that green transportation practices enhance firm performance, though implementation costs and contextual challenges may moderate the outcomes. Despite this growing evidence base, limited research specifically addresses airlines in Kenya, where sustainability and competitiveness pressures are high. To address this gap, the present study hypothesizes:

H₀₁: There is no significant effect of green transportation on airline performance in Kenya

3. Methodology

This study adopted an explanatory research design, which was appropriate for analyzing the causal relationship between green transportation practices (independent variable) and airline performance (dependent variable). The design enabled hypothesis testing and identification of significant associations between variables, while also allowing for the establishment of causal inferences supported by empirical evidence (Cohen et al., 2011; Hammersley, 2013). The target population comprised 65 airlines operating at Jomo Kenyatta International Airport (JKIA), including 40 passenger airlines and 25 cargo airlines. From this population, the unit of observation was 260 Heads of Departments (HODs) in functional areas such as procurement, logistics, marketing, and human resources, as they play a direct role in implementing green transportation practices within their respective organizations.

3.1. Sampling and Data Collection

A stratified random sampling technique was employed to ensure representation across passenger and cargo airlines, consistent with recommendations for heterogeneous populations (Zikmund et al., 2014). Using Yamane's (1967) formula, the study determined a sample size of 56 airlines, which included 34 passenger and 22 cargo carriers, resulting in 224 HOD respondents. A structured questionnaire served as the primary data collection tool, designed around the study objectives and hypotheses, and employed 5-point Likert scale questions to capture uniform and quantifiable responses (Cooper & Schindler, 2011). Pilot testing was carried out using 10% of the sample size with Jambojet employees to evaluate validity and refine the instrument (Connelly, 2008). Reliability was tested using Cronbach's Alpha, with a threshold of 0.7 or higher considered acceptable (Cronbach, 1951; Zikmund et al., 2014). Validity was established through face, content, criterion, and construct assessments, guided by expert review and theoretical alignment (Creswell & Creswell, 2017; Kothari, 2015).

3.2. Data Analysis and model specification

Data collected were cleaned, coded, and entered into SPSS Version 25 for analysis. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to summarize the demographic and study variables. Cross-tabulations facilitated clearer interpretation of findings. For hypothesis testing, inferential analyses were conducted: Pearson correlation analysis assessed the strength and direction of associations between green transportation practices and airline performance, while multiple linear regression determined the predictive effect of the independent variable on the dependent variable. Results were presented in tables and figures for clarity, providing both descriptive and inferential insights into how green transportation practices influence airline performance in Kenya. The following section presents various regression models created to evaluate the study's hypotheses.

$$Y = \beta_0 + \beta_1 x_1 + \varepsilon$$

Where, Y = performance of airline, X_1 = green transportation. β_0 = Constant term, β_1 = Coefficients of the Regression (change of airline performance as a result of change in independent variables)

ε = Error term

4. Findings

The study examined the effect of green transport practices on airline performance using data collected from 224 questionnaires distributed to Heads of Departments in 56 airlines. A total of 182 questionnaires were returned, yielding a high response rate of 88.4%. After screening for missing data and outliers, 176 valid responses were retained, representing a usable response rate of 78.6%. This rate surpasses the 60% benchmark suggested by Blumberg et al., (2014), affirming the adequacy of the sample for statistical analysis. The small proportion of unusable questionnaires (0.03%) further demonstrates that most respondents provided complete and reliable information, thereby strengthening the credibility and representativeness of the study's findings.

4.1. Respondents Characteristics

The study sample comprised 54% male and 46% female Heads of Departments (HODs), reflecting a balanced gender distribution across functional areas such as procurement, marketing, human resources, and logistics. Most respondents were aged 30–39 years (48.9%), followed by those 50 years and above (30.1%), indicating that leadership roles are largely occupied by experienced professionals, while only 17% were aged 20–29 years. In terms of education, 43.8% held a bachelor's degree, 25.6% a PhD, and 6.3% a master's degree, highlighting the importance of higher education in leadership, though some roles were also accessible to diploma (19.3%) and certificate (5.1%) holders. Regarding experience in green transportation practices, 42.6% had 6–10 years, 27.3% had 0–5 years, 19.9% had 11–15 years, and 10.2% had over 15 years, reflecting a workforce with both seasoned and relatively new professionals in sustainability practices.

Table 1: Respondents' Characteristics

		Frequency	Percent
Gender	Female	81	46
	Male	95	54
	Total	176	100
Age bracket	20-29 years	30	17
	30 - 39 years	86	48.9
	40 - 49 years	7	4
	50 years and above	53	30.1
	Total	176	100
Academic qualification	Certificate	9	5.1
	Diploma	34	19.3
	Bachelor's degree	77	43.8
	Master degree	11	6.3
	PhD	45	25.6
	Total	176	100
Years in green Logistics practices	0-5 years	48	27.3
	6-10 years	75	42.6
	11-15 years	35	19.9
	Above 15 years	18	10.2
	Total	176	100

Source; Field Data (2025)

4.2. Descriptive Statistics

The findings in Table 2 reveal that employees perceive airline performance in Kenya positively across key indicators such as profitability, market share, competitiveness, customer service, and customer loyalty, with mean scores ranging between 4.18 and 4.53. Profitability was rated highest ($M = 4.53$, $SD = 1.04$), while overall performance averaged 4.25, reflecting strong confidence in financial success and strategic growth. Negative skewness values (-1.71 to -2.32) show responses clustered toward higher ratings, while kurtosis values (2.65 to 4.33) indicate leptokurtic distributions, suggesting strong consensus among employees. These results underscore the perception of effective management strategies that drive competitiveness, customer satisfaction, and organizational success, aligning with prior literature that emphasizes financial stability, market presence, and customer retention as critical airline performance drivers.

Table 2: Airline Performance

n=264	Std.			
	Mean	Deviation	Skewness	Kurtosis
The airline's profitability has increased in recent years.	4.53	1.04	-2.32	4.33
The airline has successfully expanded its market share in the Kenyan aviation industry.	4.38	0.95	-2.01	3.97
The airline is competitive in terms of market share compared to other airlines operating in Kenya.	4.23	1.01	-1.90	3.63
I am satisfied with the overall customer service experience provided by the airline.	4.18	0.91	-1.71	3.49
The airline has a high level of customer loyalty, as evidenced by repeat business and positive reviews.	4.23	1.07	-1.73	2.65
Airline Performance	4.25	0.94	-2.21	4.33

Source: (Survey Data, 2025)

The findings in Table 3 show that organizations strongly embrace green transportation practices, with overall high mean scores ranging from 4.22 to 4.82. The most emphasized initiatives were the reuse of recycled containers ($M = 4.82$, $SD = 0.54$) and waste recovery from logistics processes ($M = 4.79$, $SD = 0.55$), highlighting a strong focus on circular economy principles. While practices such as returning logistics equipment to suppliers ($M = 4.29$, $SD = 0.72$) and recovering harmful tools ($M = 4.22$, $SD = 0.67$) were slightly lower, they still reflect considerable adoption of sustainability measures. Documented policies on material reuse ($M = 4.25$, $SD = 0.77$) and preference for recycled products ($M = 4.41$, $SD = 0.65$) further indicate organizational commitment to environmentally responsible procurement. Negative skewness values across all items confirm that most responses leaned toward higher ratings, showing strong consensus on sustainability adoption, while kurtosis values suggest responses were largely clustered around the mean with high agreement on certain practices. Overall, the descriptive statistics affirm that green transportation is well-integrated into company operations, setting a solid basis for further analysis of its impact on efficiency, financial performance, and environmental outcomes.

Table 3: Descriptive Statistics for Green transportation

n=176	Mean	Std. Deviation	Skewness	Kurtosis
My company reuses recycled containers and other appropriate material.	4.82	0.54	-1.20	2.03
My company recovers waste materials from Logistics processes and used-up materials.	4.79	0.55	-0.78	1.57
My company has a system to return the equipment used in Logistics to suppliers.	4.29	0.72	-0.96	1.71
My organization recovers all Logistics tools that are harmful to environment.	4.22	0.67	-0.98	3.03
There are documented policies, processes and procedures that relate to reuse of materials in my company.	4.25	0.77	-1.46	3.24
My organization purchases recycled products when offered in the market as opposed to new products.	4.41	0.65	-1.28	3.76
Green transportation	4.49	0.33	-0.66	-0.14

Source: (Survey Data, 2025)

4.3. Correlation Analysis

The correlation analysis presented in Table 4 examines the relationships between various green transport management practices and airline performance. The findings indicate that green transportation exhibits the strongest positive and significant correlation with airline performance ($\rho = 0.637$, $p < 0.01$), suggesting that improvements in environmentally friendly transportation practices are closely linked to enhanced airline performance.

Table 4: Correlation Analysis

	Airline Performance	Green Transportation
Airline performance	1	
green transportation	.637**	1

** Correlation is significant at the 0.01 level (2-tailed).

Source: (Survey Data, 2025)

4.4. Regression Analysis (Hypotheses Test)

The regression results in Table 5 show that green transportation had a significant positive effect on airline performance ($\beta = 0.637$, $p = 0.000$). The model achieved a correlation coefficient of $R = 0.637$, with an R^2 of 0.406, showing that 40.6% of the variation in airline performance is explained by green transportation practices. The adjusted R^2 of 0.402 further confirms that the model is stable and reliable, while the standard error of estimate (0.575) suggests a reasonably good fit of the data to the regression line. In addition, the ANOVA test results ($F = 118.861$, $p = 0.000$) confirm the overall goodness of fit of the regression model, indicating that the relationship between green transportation and airline performance is not due to chance. Since the p-value is less than the significance threshold of 0.05, the null hypothesis (H_0) was rejected,

leading to the conclusion that green transportation has a statistically significant positive effect on airline performance.

Table 5: Regression Analysis

	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
(Constant)	1.438	0.271		5.302	0.000
Green transportation	0.669	0.061	0.637	10.902	0.000
Model Summary					
R	0.637				
R Square	0.406				
Adjusted R Square	0.402				
Std. Error of the Estimate	0.575				
ANOVA for goodness of fit					
F	118.861				
Sig.	.000				

a Dependent Variable: Airline performance

Source: (Survey Data, 2024)

5. Discussions

The study established that green transportation significantly influences airline performance in Kenya ($\beta = 0.637$, $p = 0.000$), leading to the rejection of the null hypothesis. This result suggests that the adoption of green transport practices such as using fuel-efficient aircraft, optimizing routes, and reducing carbon emissions positively contributes to improved operational efficiency and organizational outcomes within the Kenyan airline industry. These findings are consistent with Lu et al. (2019), who developed the Environmental Logistics Performance Index (ELPI) to assess the global effectiveness of green transportation. Their study revealed a strong correlation between Logistics efficiency and environmental performance, indicating that countries or firms excelling in green transportation tend to experience better Logistics outcomes. This supports the view that green transportation is not only environmentally responsible but also operationally advantageous. Similarly, Rehman et al. (2023) emphasized that green transportation, when supported by innovation and domestic investment, contributes to the reduction of environmental degradation. Their findings imply that Kenyan airlines adopting sustainable practices may gain not only environmental benefits but also economic advantages through improved performance and stakeholder trust. However, Shouket (2019) cautioned that without strategic integration, transportation growth may exacerbate environmental harm—underscoring the need for structured green transport policies, particularly in the aviation sector where environmental footprints can be substantial. Further regional insights are provided by Ali et al. (2024), who studied oil and gas firms in Nigeria. They found that the use of fuel-efficient vehicles significantly enhanced service quality, customer satisfaction, and retention. This aligns with the current findings by illustrating that green transport initiatives lead to tangible performance improvements across industries. Similarly, Isoghom and Daminabo (2024), in a census of road transport firms in Nigeria, reported that green transportation had a significant positive effect on environmental, social, and economic performance—demonstrating its broad impact on sustainability in supply chains.

Evidence from Kenya is reinforced by Mutua et al. (2020), who surveyed Logistics firms and found a strong positive relationship between green supply chain practices (including transportation) and firm performance ($\beta = 0.63$, $p < 0.001$). Their study further revealed that this relationship is partly mediated by economic performance, suggesting that firms embracing green Logistics are more likely to achieve financial gains. This directly parallels the current findings in the aviation sector and supports the call for more widespread green initiatives within Kenyan industries. In Zimbabwe, Kanyepe et al. (2023) found that green Logistics practices including route optimization and eco-driving improved operational performance, particularly when supported by strong management commitment. These findings reinforce the argument that leadership plays a critical role in the successful implementation of sustainable transportation practices; a factor Kenyan airline should consider for enhancing their green Logistics capabilities.

However, a nuanced perspective is offered by Mlambo et al. (2024) in South Africa, where the adoption of advanced green transportation technologies was associated with a short-term decline in operational performance, primarily due to high upfront costs. This finding suggests that while green transportation may deliver long-term sustainability benefits, it can initially challenge firms' financial performance, especially smaller or resource-constrained companies. This trade-off highlights the importance of phased investments, financial planning, and policy support when introducing green innovations in aviation. Danial and Rahmat (2024), in a study of Malaysian Logistics firms, confirmed that green transportation significantly enhances sustainable Logistics performance. Their findings showed that increased adoption of eco-friendly transport practices led to better financial, environmental, and social outcomes underscoring the multifaceted value of sustainable transport solutions. Thus, the current study's findings align well with global, regional, and local evidence that green transportation serves as a catalyst for enhanced organizational performance. For Kenyan airlines, this suggests that investing in environmentally sustainable transport practices not only contributes to ecological goals but also offers measurable operational and economic benefits. Nevertheless, careful planning, stakeholder buy-in, and appropriate financial models are essential to ensure the sustainability and scalability of such initiatives.

6. Conclusions

In conclusion, based on the regression findings, green transportation practices are crucial in improving the performance of airlines. The results indicate that sustainable transportation practices, such as reusing recycled containers, recovering waste materials from Logistics processes, and integrating fuel-efficient aircraft, significantly enhance airline performance. In adopting these practices, airlines can reduce operational costs, improve fuel efficiency, and minimize their carbon footprint, thereby aligning with global environmental standards. Additionally, sustainable transportation supports regulatory compliance and enhances the public image of airlines as environmentally responsible entities.

7. Recommendations of Study

7.1. Managerial Recommendations

Airline management should prioritize the adoption of sustainable transportation practices by investing in fuel-efficient aircraft, optimizing flight routes to reduce fuel consumption, and integrating carbon emission reduction programs. Additionally, managers should encourage the use of alternative energy sources and implement waste recovery initiatives in Logistics

processes. Enhancing staff training on sustainable transportation practices will further improve operational efficiency and sustainability. Airlines should integrate digital technologies such as AI-based flight scheduling and real-time fuel monitoring systems to improve efficiency. Additionally, implementing carbon offset programs, such as tree-planting initiatives or investing in renewable energy projects, will enhance sustainability efforts.

7.2. Policy Recommendations

To enhance sustainability in Kenya's aviation sector, regulatory bodies must implement policies that support green transportation, warehousing, packaging, and reverse Logistics. The Kenya Civil Aviation Authority (KCAA) should mandate the adoption of fuel-efficient aircraft, carbon emission reduction strategies, and alternative energy sources, while the Kenya Airports Authority (KAA) should invest in sustainable airport infrastructure to facilitate eco-friendly aviation practices. Additionally, National Environmental Management Authority (NEMA) should establish clear guidelines for green warehousing, promoting energy-efficient storage systems and waste reduction measures. Given the high costs associated with green warehousing, policymakers should introduce funding programs, tax incentives, and grants to encourage airline operators to transition toward more sustainable practices.

7.3. Future Studies

This study offered valuable insights into the effect of green transportation on airline performance in Kenya but was limited by its focus on a single industry and reliance on quantitative methods. Future research should examine the long-term impact of green transportation strategies, consider differences across airline business models, and explore the cost-related challenges of green warehousing. Comparative studies across regions and sectors, as well as qualitative approaches like case studies or interviews, are recommended to provide a broader and deeper understanding of how green logistics practices influence sustainability and performance.

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