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Evaluating Automobile System Performance and Economic Viability in Nigeria: Evidence from Port Harcourt

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Abstract- ***This study evaluated the system performance and economic viability of automobile vehicles within the Nigerian context, with specific focus on Port Harcourt, Rivers State. The study examined key technical performance indicators such as engine efficiency, fuel consumption, brake responsiveness, suspension quality and electronic control systems, alongside economic factors including purchase price, maintenance expenses, fuel costs and resale value. A descriptive research design was adopted, and data were collected through structured questionnaires administered to automobile owners, commercial operators, mechanics and dealership personnel. Out of 320 questionnaires distributed, 298 valid responses were obtained and analyzed using descriptive statistics, including frequency tables and percentages. The findings revealed that engine power, fuel efficiency and braking systems are critical determinants of vehicle reliability, safety and operational efficiency. Fuel costs, acquisition expenses and maintenance requirements were identified as the major economic factors affecting automobile ownership and sustainability. The study further identified infrastructural deficiencies, fluctuating fuel prices, inadequate spare parts availability and weak regulatory enforcement as significant constraints affecting both system performance and economic viability in Nigeria. The study concluded that improving automobile sustainability requires an integrated approach involving technological innovation, improved maintenance practices, supportive government policies and infrastructural development. Recommendations include the promotion of fuel-efficient vehicles, encouragement of local spare parts production, enhancement of road infrastructure and implementation of stronger automotive regulations.***

Keywords: Automobile Systems, Vehicle Performance, Economic Viability, Fuel Efficiency, Maintenance Cost, Nigeria.

I. INTRODUCTION

The automobile industry plays a crucial role in transportation, industrial development and economic growth across the world. Advances in automotive engineering have significantly improved vehicle efficiency, safety, reliability and environmental sustainability. Modern vehicles are increasingly equipped with sophisticated technologies designed to enhance performance and reduce operational costs. However, the effectiveness of these systems largely depends on operating conditions, maintenance culture and economic realities within different regions.

In developing countries such as Nigeria, automobile ownership is influenced not only by technical performance but also by economic considerations. Most vehicle users prioritize affordability, fuel economy, durability and maintenance costs when making purchasing decisions. The Nigerian automobile market is characterized by a high dependence on imported used vehicles, many of which operate under poor road conditions and inconsistent maintenance practices. These realities often reduce vehicle efficiency and increase operational expenses.

Evaluating system performance alongside economic viability is therefore essential for understanding how automobile technologies perform within local conditions. System performance includes factors such as engine efficiency, fuel consumption, braking systems, suspension quality and electronic control systems, while economic viability considers purchase price, maintenance costs, fuel expenses and resale value.

The increasing demand for sustainable transportation and the emergence of advanced vehicle technologies such as electric and hybrid vehicles have further intensified the need for integrated performance and economic assessments. Such evaluations provide useful information for manufacturers, consumers and policymakers seeking to improve transportation efficiency and affordability.

This study therefore evaluates the system performance and economic viability of automobile vehicles in Port Harcourt, Rivers State, Nigeria, with the aim of identifying the major technical and economic factors influencing vehicle sustainability.
The aim of this study is to evaluate the system performance and economic viability of automobile vehicles in Port Harcourt, Rivers State, Nigeria.

The specific objectives of the study are to:

i. Assess the technical performance of key automobile systems including engine efficiency, fuel consumption, braking systems and suspension quality.
ii. Examine the economic viability of automobile vehicles with respect to acquisition costs, maintenance expenses, fuel costs and resale values.
iii. Identify the major factors affecting automobile system performance under Nigerian operating conditions.
iv. Determine the major economic challenges influencing automobile ownership and sustainability in Nigeria.
v. Recommend practical strategies for improving automobile system performance and economic viability.

II. LITERATURE REVIEW

2.1 Automobile System Performance

Automobile system performance refers to the efficiency, reliability and functionality of vehicle components under different operating conditions. Important performance indicators include engine power, fuel efficiency, braking efficiency, suspension quality and emission control systems.

Engine efficiency remains one of the most important measures of vehicle performance because it determines power output, fuel consumption and emissions. Efficient engines improve operational reliability while reducing fuel costs and environmental pollution. Brake responsiveness and suspension quality also contribute significantly to safety, comfort and vehicle durability.

Modern automobiles increasingly utilize electronic control systems and onboard diagnostics to improve performance monitoring and predictive maintenance. These technologies enable real-time adjustments to engine operations and help reduce system failures.

Despite these advancements, several challenges continue to affect vehicle performance in developing economies. Poor road conditions, inconsistent maintenance practices and the widespread use of imported used vehicles reduce operational efficiency and increase maintenance demands.

2.2 Economic Viability of Automobile Vehicles

Economic viability refers to the ability of a vehicle to remain financially sustainable throughout its operational lifecycle. It includes acquisition costs, fuel expenses, maintenance costs, insurance, depreciation and resale value.

The total cost of ownership framework is widely used in evaluating automobile economic viability because it considers both short-term and long-term expenses. Although some advanced vehicle technologies may have high initial costs, they often provide lower operational and maintenance expenses over time.

Fuel costs are among the most significant economic considerations affecting automobile ownership in Nigeria. Fluctuations in fuel prices directly influence

transportation expenses and consumer preferences. Similarly, maintenance costs are heavily influenced by spare parts availability, servicing infrastructure and vehicle durability.

Government policies such as import duties, subsidies and tax incentives also affect vehicle affordability and adoption. Supportive regulations can encourage the use of fuel-efficient and environmentally friendly vehicles.

2.3 Theoretical Framework

The study adopted the Technology Acceptance Model (TAM) as its theoretical framework. TAM explains how users accept and utilize new technologies based on perceived usefulness and perceived ease of use.

Within the automobile industry, TAM helps explain consumer acceptance of modern automotive technologies such as fuel-efficient engines, electronic control systems and electric vehicles. Technologies perceived as useful and easy to operate are more likely to gain market acceptance.

2.4 Empirical Review

Previous studies have highlighted the relationship between technical performance and economic sustainability in the automobile industry. Research has shown that fuel efficiency, maintenance requirements and operational reliability significantly influence consumer decisions and vehicle affordability.

Studies on electric vehicle adoption have further demonstrated that high initial acquisition costs and infrastructural challenges remain barriers to widespread acceptance, particularly in developing economies. Other empirical investigations have emphasized the importance of predictive maintenance technologies and advanced diagnostics in improving system performance and reducing operational costs.

III. METHODOLOGY

The study adopted a descriptive research design to evaluate automobile system performance and economic viability within Port Harcourt, Rivers State, Nigeria. The target population comprised automobile owners, commercial operators, mechanics and dealership personnel.

A purposive sampling technique was employed to select 320 respondents with relevant knowledge and experience related to vehicle operations and maintenance. Out of the distributed questionnaires, 298 valid responses were returned and analyzed.

Data were collected using structured questionnaires containing closed-ended questions and Likert-scale items. The instrument covered variables relating to technical performance indicators and economic factors associated with automobile ownership.

The validity of the instrument was established through expert review and pilot testing, while reliability was confirmed using the test-retest method, which yielded a reliability coefficient of 0.87.

Descriptive statistical tools, including frequency distributions and percentages, were used for data analysis.

IV. RESULTS AND DISCUSSION

4.1 Demographic Characteristics of Respondents

Table 4.1: Gender Distribution of Respondents

Gender	Frequency	Percentage (%)
Male	218	73.2
Female	80	26.8
Total	298	100

Source: Field Survey, 2026.

The table above shows that the majority of respondents were male, representing 73.2% of the total respondents, while female respondents accounted for 26.8%. This reflects the male dominance commonly observed in automobile-related occupations and vehicle ownership within the study area.

Table 4.2: Age Distribution of Respondents

Age Range (Years)	Frequency	Percentage (%)
18–29	64	21.5
30–39	110	36.9

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Age Range (Years)	Frequency	Percentage (%)
40–49	82	27.5
50 and above	42	14.1
Total	298	100

Source: Field Survey, 2026.

The data indicate that the largest proportion of respondents falls within the 30–39 years age bracket, representing 36.9% of the total respondents. This suggests that most participants are within the active working population and are directly involved in automobile usage and maintenance activities.

Table 4.3: Educational Qualification of Respondents

Educational Level	Frequency	Percentage (%)
Primary School	18	6.0
Secondary School	92	30.9
Polytechnic/Technical	74	24.8
University Degree	96	32.2
Postgraduate Qualification	18	6.1
Total	298	100

Source: Field Survey, 2026.

The table shows that the respondents were fairly educated, with the majority possessing either secondary, polytechnic or university education. This educational background suggests that respondents were capable of providing informed responses regarding technical and economic aspects of automobile systems.

Table 4.4: Occupation of Respondents

Occupation	Frequency	Percentage (%)
Private Vehicle Owners	112	37.6
Commercial Operators	74	24.8
Mechanics	56	18.8
Dealership Personnel	56	18.8
Total	298	100

Source: Field Survey, 2026.

The findings reveal that private vehicle owners constituted the largest category of respondents, accounting for 37.6%, followed by commercial operators at 24.8%. Mechanics and dealership personnel jointly represented 37.6% of the respondents, ensuring balanced representation of both users and technical experts.

Table 4.5: Years of Vehicle Ownership/Professional Experience

Years of Experience	Frequency	Percentage (%)
Less than 3 Years	56	18.8
3–5 Years	78	26.2
6–10 Years	96	32.2
More than 10 Years	68	22.8
Total	298	100

Source: Field Survey, 2026.

The results indicate that the majority of respondents had between 6 and 10 years of automobile ownership or professional experience. This level of experience enhances the reliability of the data collected because respondents possessed substantial practical exposure to automobile performance and economic issues.

4.2 Technical Performance of Automobile Systems

Table 4.6: Respondents' Views on Technical Performance Indicators of Automobile Systems

Performance Indicator	SA	%	A	%	D	%	SD	%	Total
Engine power and torque affect vehicle reliability	142	47.7	98	32.9	40	13.4	18	6.0	298
Fuel efficiency is critical for system performance	130	43.6	110	36.9	38	12.8	20	6.7	298

Performance Indicator	SA	%	A	%	D	%	SD	%	Total
Brake system responsiveness affects vehicle safety	160	53.7	98	32.9	25	8.4	15	5.0	298
Suspension quality affects ride comfort and durability	110	36.9	124	41.6	40	13.4	24	8.1	298
Electronic control systems improve vehicle efficiency	138	46.3	105	35.2	38	12.8	17	5.7	298

Source: Field Survey, 2026.

The findings presented in Table 4.6 indicate that respondents strongly acknowledged the importance of technical performance indicators in determining automobile efficiency, safety and reliability. A combined majority of respondents agreed that engine power and torque significantly influence vehicle reliability and operational effectiveness.

Fuel efficiency was also identified as a critical determinant of automobile performance because of its direct relationship with fuel consumption and operating expenses. Most respondents further agreed that brake system responsiveness greatly affects vehicle safety and accident prevention.

The results additionally revealed that suspension quality contributes significantly to ride comfort and durability, particularly under poor road conditions commonly experienced in Nigeria. Electronic control systems were also recognized as important technologies that enhance efficiency, improve diagnostics and support better vehicle operation.

Overall, the findings suggest that technical performance remains a major factor influencing vehicle ownership decisions and operational sustainability.

4.3 Economic Viability of Automobile Vehicles

Table 4.7: Respondents' Views on Economic Viability of Automobile Vehicles

Economic Factor	SA	%	A	%	D	%	SD	%	Total
Purchase price is the major cost factor in vehicle ownership	150	50.3	95	31.9	35	11.7	18	6.1	298
Fuel costs significantly affect vehicle affordability	160	53.7	98	32.9	25	8.4	15	5.0	298
Maintenance expenses affect overall economic viability	140	47.0	100	33.6	38	12.8	20	6.6	298
Resale value influences economic sustainability	130	43.6	112	37.6	32	10.7	24	8.1	298
Availability of spare parts affects maintenance cost	145	48.7	102	34.2	30	10.1	21	7.0	298

Source: Field Survey, 2026.

The results presented in Table 4.7 show that respondents strongly agreed that purchase price is one of the most significant economic considerations influencing automobile ownership decisions. A large proportion of respondents also agreed that fuel costs greatly affect vehicle affordability, especially due to frequent fluctuations in fuel prices.

Maintenance expenses were identified as another major factor affecting economic viability. Vehicles that require regular repairs or expensive spare parts were considered less sustainable economically.

The findings further revealed that resale value plays an important role in determining long-term financial sustainability because vehicles with higher durability and reliability tend to retain better market value over time.

Additionally, respondents acknowledged that the availability of spare parts significantly influences maintenance cost and operational efficiency. Limited access to quality spare parts often increases repair expenses and reduces vehicle reliability.

Overall, the findings indicate that acquisition cost, fuel expenses, maintenance requirements and resale

value are critical factors influencing the economic viability of automobile vehicles in Nigeria.

4.4 Discussion of Findings

The findings confirm that automobile system performance and economic viability are closely interconnected. Efficient engine systems, reliable braking mechanisms and modern electronic controls improve operational performance while reducing long-term maintenance costs.

Similarly, economic factors such as fuel prices, acquisition costs and maintenance expenses significantly influence consumer preferences and ownership sustainability.

The Nigerian automobile sector faces unique challenges including poor road infrastructure, dependence on imported used vehicles and unstable fuel pricing. These challenges reduce system efficiency and increase operational costs.

The study therefore emphasizes the need for integrated strategies involving technological improvements, infrastructural development and supportive government policies to enhance transportation sustainability.

CONCLUSION

This study evaluated the system performance and economic viability of automobile vehicles in Port Harcourt, Rivers State, Nigeria. The findings demonstrated that technical performance indicators such as engine efficiency, fuel economy, brake responsiveness and electronic control systems significantly influence vehicle reliability and sustainability.

Economic factors including purchase price, fuel costs, maintenance expenses and resale value were also identified as major determinants of automobile viability.

The study concluded that improving automobile sustainability in Nigeria requires a comprehensive approach that integrates technological innovation, effective maintenance culture, improved infrastructure and supportive policy interventions.

RECOMMENDATIONS

Based on the findings of the study, the following recommendations are proposed:

i. Automobile manufacturers should prioritize the production and importation of fuel-efficient vehicles suitable for Nigerian operating conditions.
ii. Government should implement policies that reduce vehicle acquisition costs through tax incentives and reduced import duties for efficient and environmentally friendly vehicles.
iii. Road infrastructure should be improved to reduce mechanical wear and improve vehicle durability.
iv. Local production and distribution of spare parts should be encouraged to reduce maintenance costs and improve accessibility.
v. Vehicle owners should adopt regular maintenance practices to improve system performance and reduce long-term operational expenses.
vi. Regulatory agencies should strengthen safety and emission standards to ensure better vehicle quality and environmental sustainability.

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