

Evaluating the Role of Railway Transportation in the Socio-Economic Development of Nigeria

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ABSTRACT

This study critically examines the role of railway transportation in the socio-economic development of Nigeria. It investigates how government investment in railway infrastructure, public awareness, and technological innovation contribute to key economic indicators such as job creation, trade facilitation, business growth, and income levels. Using a structured questionnaire based on a four-point Likert scale, data were collected from 293 respondents across various sectors. The study employed Pearson correlation and multiple linear regression analyses to evaluate the relationships between variables. Findings reveal a strong positive and statistically significant correlation ($r = 0.72$, $p < 0.001$) between railway infrastructure investment and economic development. Furthermore, regression analysis shows that government investment ($\beta = 0.58$), public awareness ($\beta = 0.29$), and technological adoption ($\beta = 0.35$) are significant predictors of economic progress, with the model explaining 65% ($R^2 = 0.65$) of the variance in economic development. The results underscore the critical importance of sustained investment, innovation, and public engagement in the railway sector as strategic tools for national development. The study recommends policy reforms and increased funding to modernize and expand Nigeria's railway system for improved economic outcomes.

Keywords: Railway transportation, Socio-Economic Development, Infrastructure Development, Technological Innovation, Urban-Rural Connectivity.

Introduction

Transportation plays a critical role in national development by enabling the efficient movement of people, goods, and services. Among the various modes of transportation, railways stand out for their ability to convey large volumes over long distances at relatively low cost, thereby stimulating economic activities and enhancing regional integration. In Nigeria, railway transportation has historically served as a catalyst for economic development, particularly during the colonial and early post-independence periods when it was a backbone for the extraction and export of agricultural and mineral resources^{1,2,3}. However, for several decades, the Nigerian railway system suffered from neglect, underinvestment, and outdated infrastructure, leading to a decline in its efficiency and relevance. The deterioration of railway services forced an over-reliance on road transportation, which in turn led to congestion, increased cost of logistics, high accident rates, and rapid road infrastructure decay⁴. In response to these challenges, recent years have seen a renewed interest by the Nigerian government in revitalizing and expanding railway infrastructure as part of broader national development plans. One of the most prominent efforts has been the rehabilitation and modernization of key rail corridors, including the Warri-Itakpe standard gauge railway, which serves the Ujevuwu and Itakpe train stations⁵.

The Warri-Itakpe rail line, completed and operationalized in 2020, represents a significant milestone in Nigeria's rail transport revival. Originally conceptualized to serve the Ajaokuta Steel Company, the line now holds broader economic and social promise, linking the mineral-rich North-Central region with the oil-producing South-South zone. The strategic location of Ujevuwu station in Delta State and Itakpe in Kogi State allows them to function as vital nodes in facilitating regional trade, easing passenger movement, and promoting industrial growth. Ujevuwu serves as the terminus for people and goods heading into the bustling Warri metropolis and adjoining oil-producing communities, while Itakpe provides crucial access to inland markets and mining zones⁶.

Railway transportation contributes to socio-economic development through multiple channels. First, it enhances mobility and accessibility, especially for low-income populations who benefit from lower transport costs compared to road options^{7,8}. Second, it stimulates local economies by creating direct and indirect employment opportunities, ranging from railway operations to ancillary services such as trade, logistics, and hospitality⁹. Third, improved rail connectivity can spur industrialization by lowering the cost of transporting raw materials and finished goods, thereby improving competitiveness and market access. Additionally, the environmental benefits of rail, including lower greenhouse gas emissions and reduced fossil fuel dependence, make it a more sustainable mode of transport compared to road transport¹⁰.

Despite these potentials, the actual impact of railway development on socio-economic outcomes in Nigeria remains under-researched, particularly at the local level. There is a paucity of empirical data on how modern railway stations, such as Ujevuwu and Itakpe, influence the lives and livelihoods of surrounding communities. While government narratives often highlight the macroeconomic benefits of large-scale infrastructure, less attention is paid to localized socio-economic transformations, including changes in employment patterns, small business growth, land value appreciation, and social mobility. As such, a case study focusing on these two railway nodes can fill an important gap by offering grounded insights into the dynamics of railway-led development.

Moreover, understanding the local socio-economic implications of railway transportation is vital for designing inclusive and sustainable transport policies. It can inform future investments and aid in maximizing the developmental impact of transportation infrastructure. For instance, lessons drawn from the Ujevuwu-Itakpe corridor could help guide the planning and management of emerging rail projects, such as the Lagos-Kano and Port Harcourt-Maiduguri lines.

This study seeks to critically examine the role of railway transportation in Nigeria's socio-economic development using Ujevuwu and Itakpe stations as case studies. It will assess the extent to which these transport hubs have influenced economic activities, improved social welfare, and contributed to regional integration. By doing so, the research aims to offer policy-relevant evidence that supports the ongoing transformation of Nigeria's transportation landscape, while also highlighting challenges and opportunities for more equitable development.

2. Comparative Studies and Global Contextualization

Railway transportation has historically played a transformative role in the socio-economic development of many countries around the world. From the Industrial Revolution in Europe to the economic integration of East Asia, rail infrastructure has been a key enabler of regional connectivity, trade expansion, and inclusive development. The experience of other countries provides valuable insights into the potential of railway systems to catalyze growth and reduce spatial inequalities, an aspiration that Nigeria seeks to achieve through its recent investments in rail infrastructure, such as the Itakpe-Warri corridor.

In Europe, particularly in countries like Germany and France, rail transportation is central to national logistics and passenger mobility systems. The German Deutsche Bahn (DB) and the French Société Nationale des Chemins de fer Français (SNCF) are examples of how state-supported rail companies can modernize transport services while contributing significantly to GDP through job creation, tourism promotion, and freight movement (European Commission, 2020). High-speed rail systems in these countries have facilitated regional development by decentralizing economic activity and reducing pressure on urban centers.

Similarly, in East Asia, China's experience is particularly instructive. China has developed the most extensive high-speed rail (HSR) network in the world, exceeding 40,000 kilometers by 2023¹¹. The development of China's rail system has led to massive socio-economic gains, including reduced travel time, improved access to education and healthcare, and the revitalization of underdeveloped regions¹². Empirical studies reveal that the expansion of railway lines in China correlates strongly with regional economic convergence and poverty reduction, especially in interior provinces¹³.

China's model demonstrates how targeted rail investments, accompanied by industrial and urban development policies, can foster inclusive growth.

In contrast, sub-Saharan Africa has generally lagged in developing modern rail networks. Historically, most African railway systems were constructed during colonial times with the primary objective of extracting resources rather than promoting intra-national connectivity or development¹⁴. As a result, many African rail systems remain poorly integrated and underfunded. However, some African countries have begun to reverse this trend. Ethiopia, for example, has made significant strides through the construction of the Addis Ababa-Djibouti electric railway line. This line has not only enhanced trade efficiency but has also contributed to industrialization efforts in Ethiopia by facilitating access to the country's industrial parks¹⁵. Similarly, Kenya's Standard Gauge Railway (SGR), connecting Mombasa to Nairobi and now extending toward Naivasha, has been linked with increased regional trade, urban development, and job creation¹⁶.

The Nigerian context shares both challenges and opportunities seen in other developing economies. The rehabilitation of the Warri-Itakpe standard gauge railway, which passes through Ujevuwu and Itakpe stations, presents an opportunity to emulate the development successes observed in countries like Ethiopia and Kenya. However, challenges such as land acquisition disputes, vandalism, poor intermodal connectivity, and weak maintenance regimes still hinder the full realization of the railway's socio-economic potential^{17,18}.

Unlike in advanced economies, where rail transport integrates seamlessly with urban and industrial planning, Nigeria's railway development has often been undertaken in isolation from complementary infrastructure such as roads, inland ports, and logistics hubs. This disjointed approach may limit the multiplier effects of railway investments, particularly in peri-urban and rural areas. Moreover, the absence of a comprehensive rail-oriented development policy means that opportunities for industrial clustering, tourism development, and real estate growth around train stations like Ujevuwu and Itakpe are underutilized.

Nevertheless, the global literature emphasizes that railways can significantly enhance national productivity and regional cohesion if supported by effective governance frameworks, multi-sectoral planning, and sustained investment. As Nigeria moves forward with other railway projects such as the Lagos-Kano, Port Harcourt-Maiduguri, and Abuja-Kaduna lines, comparative case studies from China, Kenya, and Ethiopia suggest that success depends on more than infrastructure alone, it requires integrating transport development with economic diversification strategies, labor market reforms, and environmental safeguards¹⁹.

In summary, global experiences affirm the transformative potential of railway transport systems when embedded within coherent development frameworks. The case of Ujevuwu and Itakpe presents a microcosm for examining how railway stations can drive local and national development goals. Learning from comparative models can help Nigeria avoid common pitfalls and leverage rail infrastructure to achieve broad-based socio-economic advancement.

3. Theoretical Framework of the Study

The theoretical framework guiding this study draws from the concept of Transportation Economics and the System Theory, providing a comprehensive lens through which to analyze the impact of railway transportation on the Nigerian economy.

Transportation Economics: The study aligns with the principles of Transportation Economics, a field that explores the economic aspects of transportation systems. The economic efficiency of a transportation system is crucial for overall economic development²⁰. The cost-effectiveness of transporting goods and people is a fundamental consideration, and the study aims to assess how railway transportation contributes to the reduction of logistics costs, subsequently influencing the cost of goods in the market²¹.

Systems Theory: Drawing on the Systems Theory perspective, the study views the railway transportation system as a complex, interconnected set of elements that work together to achieve specific objectives²². The railway system, in this context, comprises various components such as infrastructure, rolling stock, and operational processes. By adopting a systemic approach, the study seeks to understand how changes or developments in one part of the railway system can have cascading effects on the entire economic structure of Nigeria.

Input-Output Model: The Input-Output Model, as proposed by²³, serves as a methodological tool for assessing the interdependencies between different sectors of the economy. This model helps to elucidate the direct and indirect effects of changes in the railway sector on other economic activities. For example, an increase in railway infrastructure development may lead to a boost in employment and production in related industries, thereby contributing to overall economic growth.

Dependency Theory: The Dependency Theory, as articulated by²⁴, is considered in the analysis of how the railway sector's development can influence regional disparities. This theoretical perspective helps in understanding whether the railway system contributes to a more balanced regional development or exacerbates existing economic disparities²⁵.

4. Materials and Methods

The Ujevwu-Itakpe Railway, officially part of the Itakpe-Warri Standard Gauge Railway Line, is a landmark infrastructure project in Nigeria's transportation landscape. It serves as a major corridor linking the North-Central and South-South geopolitical zones of Nigeria. Spanning approximately 327 kilometers, the railway line connects Itakpe in Kogi State to Ujevwu in Delta State, traversing through parts of Edo State, including key towns like Ajaokuta, Agenebode, Uromi, and Agbor. The railway forms a strategic part of Nigeria's broader plan to revitalize rail transport and enhance regional integration, trade, and economic development. The rail line effectively links the inland mineral belt of Nigeria with its coastal industrial and export zones, promoting interregional trade, logistics efficiency, and passenger mobility. Itakpe Station is situated in Kogi State, within the North-Central region of Nigeria. The area is predominantly known for mining activities, especially iron ore, and is home to the Ajaokuta Steel Complex, one of the largest industrial projects in West Africa. Ujevwu Station, located near Warri in Delta State, lies in the heart of the South-South region, known for its oil and gas reserves. Ujevwu serves as the southern terminus of the railway and is strategically positioned to serve the industrial and commercial zones around Warri, Effurun, and environs. The Itakpe-Ujevwu (Warri) line, originally conceived in the 1980s primarily to transport iron ore from Itakpe to the Ajaokuta and Aladja Steel Plants, was abandoned for decades before being revived and

completed in the late 2010s. The completed standard gauge line was officially inaugurated in September 2020 by the Federal Government of Nigeria²⁶. Key features of the railway include: 327 km of standard gauge track (1435 mm), designed for passenger and freight services, 12 stations along the route, including Itakpe, Ajaokuta, Agenebode, Uromi, Agbor, Abraka, and Ujevwu, A maximum operating speed of approximately 100–120 km/h for passenger trains and slightly lower for freight services, Bridges, culverts, and modern signaling systems to enhance safety and operational efficiency and Connection to the Warri Port and potential future integration with the Lagos-Kano rail line and other national corridors. The Ujevwu-Itakpe corridor plays a crucial role in the multi-modal transport strategy of Nigeria, aimed at decongesting road networks, reducing travel time, and lowering logistics costs. It provides an efficient alternative to the decaying road infrastructure linking the North and South, while also unlocking economic opportunities in rural and peri-urban communities along the route.

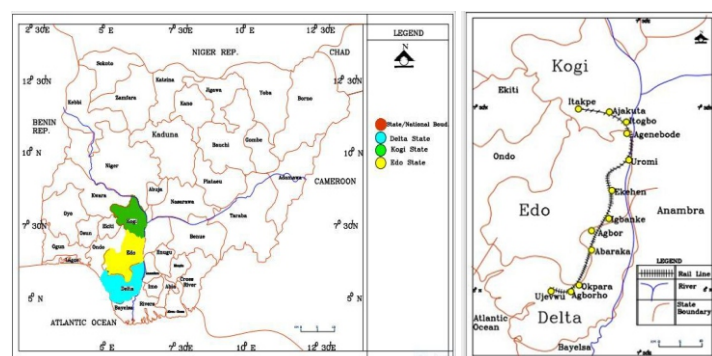


Fig. 1 and 2, showing the study States and Railway Stations (sampling points)

This study adopts a mixed-methods research design, integrating both qualitative and quantitative approaches to comprehensively investigate the socio-economic impacts of railway transportation in Nigeria, with specific focus on Ujevwu and Itakpe train stations. The mixed-methods design enables triangulation of data, enhancing the validity and reliability of findings²⁷. The research was conducted in two strategic railway nodes in Nigeria: Ujevwu in Delta State (South-South) and Itakpe in Kogi State (North-Central). Ujevwu serves as a key gateway for commuters and cargo into Warri and surrounding oil-producing communities, while Itakpe is closely linked with mining and industrial zones, including the Ajaokuta Steel Complex. These stations were selected due to their strategic location on the Itakpe-Warri Standard Gauge Railway and their contrasting socio-economic settings, which provide an ideal context for comparative analysis. The target population includes residents, business owners, commuters, and workers in and around the Ujevwu and Itakpe train stations. Other key stakeholders such as officials of the Nigerian Railway Corporation (NRC), local government officers, and transport union leaders were also considered. A purposive sampling technique was used to select a sample size of 300 respondents (150 from each location), ensuring representation across stakeholder groups. Additionally, 10 key informants (5 per location) were selected for in-depth interviews to provide expert and experiential insights into the socio-economic implications of railway operations in their communities. Both primary and secondary data were employed in this study. Primary Data: 1. Structured Questionnaires were administered to collect data from local residents and users of the railway stations.

The questionnaire was divided into sections covering demographics, economic activities, income changes, accessibility, land use, and perceived impacts of the rail service. 2. Key Informant Interviews (KIIs) were conducted using semi-structured interview guides to gain qualitative insights from NRC staff, local business leaders, and government officials. 3. Direct Observations were also made to assess physical infrastructure, station surroundings, and economic activities near the train stations. Secondary Data: Secondary sources such as published reports from the Nigerian Railway Corporation, Ministry of Transportation, academic journals, government policy documents, and development agency reports were reviewed to contextualize the findings and support data interpretation.

Instrument Validation and Reliability: To ensure validity, the research instruments were reviewed by transportation experts and tested through a pilot study involving 20 participants (10 from each site). Feedback from the pilot test was used to revise ambiguous or redundant questions.

Cronbach's alpha was used to test the internal consistency of the questionnaire, yielding an acceptable reliability coefficient of 0.81, indicating a high level of reliability²⁸.

Data Analysis: Quantitative data were coded and analyzed using Statistical Package for the Social Sciences (SPSS) Version 26. Descriptive statistics such as frequencies, means, and percentages were used to summarize demographic and socio-economic characteristics of respondents. Inferential statistics, including Chi-square tests and correlation analysis, were employed to examine relationships between railway access and socio-economic variables (e.g., income level, employment, and land use). Qualitative data from interviews were transcribed, coded, and analyzed thematically using NVivo 12. Emerging themes such as employment creation, business growth, travel convenience, and land value changes were identified and compared across the two study locations.

Ethical Considerations

Ethical approval was obtained from the appropriate institutional research ethics committee. Respondents were assured of confidentiality, and informed consent was obtained from all participants. Participation in the study was entirely voluntary, and respondents had the right to withdraw at any stage without consequence.

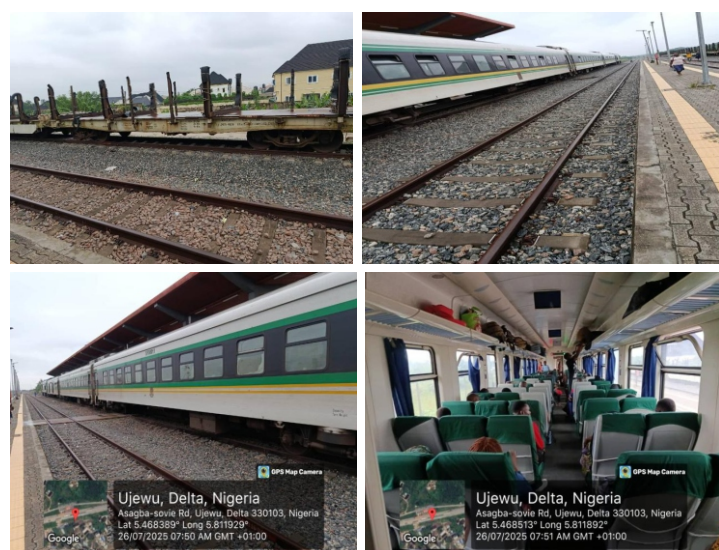


Photo clips of the study area

5. Result

Table 1: Demographic data

Variables		Frequency	Percentage
Sex	Male	95	32.4
	Female	198	67.5
Age	18–25	28	9.6
	26–35	64	21.8
	36–45	114	38.9
	46 and above	87	29.7
occupation	Trader	127	43.3
	Civil Servant	47	16.0
	Transport Worker	35	11.9
	Student	58	19.8
	Other	26	8.9
Educational Level	No formal education	7	2.4
	Primary	24	8.2
	Secondary	84	28.7
	Tertiary	178	60.8

Discussion of Demographic Characteristics of Respondents

Sex Distribution

A majority of the respondents were female (67.5%), while males accounted for 32.4%. This imbalance could reflect gender participation trends in market or public transportation settings, especially if the railway serves areas where women dominate trading and informal economic activities. Women are increasingly recognized as key stakeholders in urban transport planning due to their reliance on affordable public mobility options²⁹. Thus, their overwhelming representation is valuable for assessing the socioeconomic impact of rail infrastructure from a gendered perspective.

Age Distribution

In terms of age, the dominant group was 36–45 years (38.9%), followed by 46 and above (29.7%), 26–35 years (21.8%), and lastly 18–25 years (9.6%). This reflects a mature and economically active respondent pool, primarily made up of individuals likely to be household heads, business owners, or primary income earners. This demographic is particularly relevant in assessing long-term socioeconomic impacts, as middle-aged adults tend to have higher stakes in livelihood changes, transport reliability, and infrastructural investments³⁰.

Occupational Distribution

Occupationally, the highest proportion of respondents identified as traders (43.3%), followed by students (19.8%), civil servants (16.0%), transport workers (11.9%), and others (8.9%). The dominance of traders underlines the relevance of rail transport for commerce and goods mobility. According to³¹, traders and small business operators are among the earliest beneficiaries of improved transport connectivity, particularly in sub-Saharan contexts where logistics costs are high. The inclusion of transport workers adds credibility to the dataset, as they provide informed opinions about mobility infrastructure performance.

Educational Level

The respondents were relatively well-educated, with 60.8% having tertiary education, 28.7% secondary, 8.2% primary, and only 2.4% with no formal education. This educational profile suggests that the majority of participants possess the cognitive capacity to evaluate and articulate the economic effects of railway transport. High educational attainment among respondents also enhances the validity of perception-based assessments, as informed individuals tend to engage more critically with infrastructural developments in their communities¹⁰.

Table 2: Railway Transportation and Economic Development

	Railway trans & Eco. Develop.	SA 4	A 3	D 2	SD 1	Total	SWV	Mean	Remarks	Rank	x-x'	(x-x') ²
1.	The presence of the railway has created new job opportunities in my community.	436	297	144	13	293	880	3.00	Accepted	6 th	0.189	0.0357
2.	Railway transportation has helped boost local businesses and market access.	524	297	82	22	293	925	3.16	Accepted	3 rd	0.349	0.1218
3.	The cost of transporting goods has reduced due to railway availability	512	327	76	18	293	933	3.18	Accepted	2 nd	0.369	0.1362
4.	My income or livelihood has improved since the railway began operation here	444	297	122	22	293	885	3.02	Accepted	5 th	0.209	0.0437
5.	The railway has increased the flow of customers and goods to this area	392	207	146	54	293	799	2.73	Accepted	7 th	- 0.081	0.0066
6.	More businesses have been established around the train station	144	96	246	102	293	588	2.01	Rejected	10 th	- 0.801	0.6416
7	Real estate and land values have increased due to railway development	180	153	224	85	293	642	2.19	Rejected	9 th	- 0.621	0.3856
8	The railway has made it easier for people to travel for business purposes.	516	336	62	21	293	935	3.19	Accepted	1 st	0.379	0.1436
9	The railway has reduced economic dependency on road transport.	480	291	102	25	293	898	3.06	Accepted	4 th	0.249	0.0620
10	The railway contributes significantly to regional and national economic growth.	312	204	178	58	293	752	2.57	Accepted	8 th	- 0.241	0.0581
								28.11				1.6349
								2.811				

The data in Table 2 provides insight into the perceived impact of railway transportation on economic development based on responses from 293 participants. The findings show a grand mean score of 2.81, indicating a generally positive perception of the economic benefits of railway infrastructure. Most of the variables assessed were "Accepted" (Mean $\geq$ 2.5), except for two, which fell below the threshold and were "Rejected".

The statement with the highest mean score (3.19) was: "The railway has made it easier for people to travel for business purposes", which was ranked 1st. This suggests that enhanced mobility via rail supports business growth and expands trade opportunities. Studies have shown that improved railway systems reduce travel time, cut transportation costs, and increase the efficiency of doing business^{31,32}.

Following closely were statements such as "The cost of transporting goods has reduced due to railway availability" (Mean = 3.18, Rank = 2nd) and "Railway transportation has helped boost local businesses and market access" (Mean = 3.16, Rank = 3rd). These findings align with the assertion by³³ that efficient freight movement via rail leads to better supply chain integration and opens up markets previously constrained by road dependence.

The economic advantage of the railway in reducing dependence on road transport was also supported (Mean = 3.06, Rank = 4th). This is significant in the Nigerian context, where road networks are often congested or deteriorated. Diversifying transportation options enhances resilience and reduces logistics delays³¹.

Interestingly, two items received rejected remarks due to mean scores below 2.5: "More businesses have been established

around the train station" (Mean = 2.01, Rank = 10th) "Real estate and land values have increased due to railway development" (Mean = 2.19, Rank = 9th). These results suggest that while the railway has broad regional economic implications, localized effects such as land use optimization and business clustering near railway stations are not yet evident. This gap could be attributed to poor spatial planning, lack of transit-oriented development (TOD), or uncoordinated infrastructure rollouts. In contrast,³⁴ argue that successful TOD around rail lines, such as in Hong Kong, depends on strategic integration of transport and land-use policies.

Additionally, "The railway contributes significantly to regional and national economic growth" received a moderate score (Mean = 2.57, Rank = 8th), suggesting awareness among respondents that railways drive broader economic activities, even if immediate local impacts may be limited. The sum of squares of deviations ($\sum(x-\bar{x})^2 = 1.6349$) and the mean score deviation of 2.811 suggest moderate variability in respondents' views. This reflects a shared consensus on the broader economic gains of railway transportation, while highlighting mixed opinions on localized outcomes.

The findings indicate that while railway transportation is recognized as a catalyst for economic development, its full potential, especially in stimulating localized commercial growth and real estate appreciation, has yet to be realized in the study area. Policymakers should therefore consider strategies that link rail infrastructure with urban planning, entrepreneurship hubs, and value chain development to maximize its socio-economic benefits.

Table 3: Railway Transportation and Social Development

	Railway trans & Soci. Develop.	SA 4	A 3	D 2	SD 1	Total	SWV	Mean	Remarks	Rank	x-x'	(x-x') ²
1.	The railway has improved access to schools and educational institutions	376	216	150	52	293	794	2.71	Accepted	5 th	0.041	0.0017
2.	Railway transport has enhanced access to healthcare services.	300	210	178	59	293	747	2.55	Accepted	7 th	- 0.119	0.0142
3.	The availability of railway transport has improved social interactions and mobility	496	327	102	9	293	934	3.19	Accepted	3 rd	0.521	0.2714
4.	The train service has made travel safer for families and individuals.	520	345	62	17	293	944	3.22	Accepted	1 st	0.551	0.3036
5.	The railway has contributed to urban development around the station area.	160	150	230	88	293	628	2.14	Rejected	9 th	- 0.529	0.2798

6.	The presence of the railway has led to population growth in nearby communities.	156	114	240	96	293	606	2.07	Rejected	10 th	- 0.599	0.3588
7	The railway service has enhanced the quality of life for local residents	184	150	222	86	293	642	2.19	Rejected	8 th	- 0.479	0.2294
8	Travel time to social services (e.g., markets, banks, government offices) has reduced.	532	303	82	18	293	935	3.19	Accepted	2 nd	0.521	0.2714
9	The railway system has promoted cultural exchange and tourism	380	210	150	53	293	793	2.71	Accepted	6 th	0.041	0.0017
10	The presence of the railway has reduced social isolation in rural communities	388	195	166	48	293	797	2.72	Accepted	4 th	0.051	0.0026
								26.69				1.7346
								2.669				

The analysis presented in Table 3 explores how respondents perceive the influence of railway transportation on social development within their communities. The dataset reveals a grand mean score of 2.669, indicating a moderately positive perception of railway transportation's contribution to social development.

The highest-ranked item was: “The train service has made travel safer for families and individuals” (Mean = 3.22, Rank = 1st), suggesting widespread acknowledgment of rail transport's safety advantage over other modes like road travel. This is consistent with existing literature highlighting that railway systems, when properly managed, present fewer accidents and fatalities compared to road transport¹⁰.

Closely following were statements such as: “Travel time to social services (e.g., markets, banks, government offices) has reduced” (Mean = 3.19, Rank = 2nd), and “The availability of railway transport has improved social interactions and mobility” (Mean = 3.19, Rank=3rd).

These results emphasize the importance of accessibility in fostering social cohesion and equitable development. Efficient transport networks are known to bridge spatial gaps, enhance access to critical social services, and reduce isolation, particularly for peri-urban and rural communities²⁹.

Moreover, the statement “The railway has reduced social isolation in rural communities” (Mean = 2.72, Rank = 4th) further validates the assertion that railway systems foster connectivity and inclusion, especially among underserved populations. Similarly, improved access to schools (Mean = 2.71) and cultural exchange/tourism (Mean = 2.71) indicate that railway services are perceived to enhance educational and cultural opportunities.

However, three indicators were rejected due to mean values below 2.5: “The presence of the railway has led to population growth in nearby communities” (Mean = 2.07, Rank = 10th),

“The railway has contributed to urban development around the station area” (Mean = 2.14, Rank = 9th), and “The railway service has enhanced the quality of life for local residents” (Mean = 2.19, Rank = 8th). These results suggest that while respondents recognize improvements in mobility and service access, they do not strongly perceive transformative changes in urban development or population growth near railway areas. This reflects possible gaps in integrated infrastructure planning, real estate development, and community service provision around rail corridors. In contrast, international case studies³⁴ emphasize the synergy between railway investments and sustainable urban expansion when supported by coordinated land-use and transport policies.

Furthermore, the relatively low score on quality-of-life enhancement suggests that while rail transport solves mobility challenges, its impact on broader well-being, such as housing, income, and environmental comfort, remains limited in the current context. This could be due to poor intermodal connections, lack of station-area services, or uneven policy implementation.

The sum of squared deviations ($\sum(x-\bar{x})^2 = 1.7346$) and mean deviation of 2.669 points to moderate variability in respondents' perceptions. These fluctuations reflect differing community experiences with rail access, depending on proximity, usage patterns, and service frequency.

The findings reveal that railway transportation plays a crucial role in promoting social mobility, safety, and access to services. However, its potential to drive urban growth, population concentration, and overall quality of life remains underutilized. To fully leverage rail infrastructure for social development, policymakers should adopt inclusive planning, transit-oriented development (TOD) models, and socially integrated transport policies that address both physical access and the broader social determinants of well-being.

Table 4: Perception of Railway Services and Infrastructure

	Perception of Railway serv. & Infrastructure	SA	A	D	SD	Total	SWV	Mean	Remarks	Rank	x-x'	(x-x') ²
		4	3	2	1							
1.	The train stations are well-maintained and clean	396	195	170	44	293	805	2.75	Accepted	4 th	0.113	0.0128
2.	The railway coaches are comfortable and in good condition	376	210	78	51	293	715	2.44	Rejected	6 th	- 0.197	0.0388
3.	Train services are regular and adhere to schedule	180	153	232	81	293	646	2.20	Rejected	9 th	- 0.437	0.1909
4.	The staff at the train station are courteous and helpful	384	213	150	51	293	798	2.72	Accepted	5 th	0.083	0.0069
5.	Security measures at the railway station are adequate.	500	324	100	10	293	934	3.19	Accepted	2 nd	0.553	0.3058
6.	The ticketing process is simple and efficient.	508	327	102	6	293	943	3.21	Accepted	1 st	0.563	0.3170
7	There is adequate signage and information at the train station	192	195	166	97	293	650	2.22	Rejected	8 th	- 0.417	0.1739
8	The train services are affordable for most residents	500	348	62	18	293	928	3.17	Accepted	3 rd	0.533	0.2841
9	Railway infrastructure (tracks, bridges, terminals) is modern and reliable.	228	192	166	89	293	675	2.30	Rejected	7 th	- 0.337	0.1136
10	I am generally satisfied with the quality of railway services provided	188	180	166	103	293	637	2.17	Rejected	10 th	- 0.467	0.2181
								26.37				1.6619
								2.637				

Table 4 presents respondents' evaluations of the quality of railway services and infrastructure, a crucial component in assessing the performance and user satisfaction with rail transport systems. The analysis reveals a grand mean of 2.637, suggesting a moderately favorable but mixed perception of the services and facilities available in the current railway system. Several aspects of the railway system received positive assessments, with mean scores above 2.5 (Accepted): "The ticketing process is simple and efficient," recorded the highest mean (3.21) and was ranked 1st, suggesting that recent digitalization or system upgrades have improved the ease of accessing services. According to the³⁵, streamlined ticketing processes play a key role in enhancing the attractiveness and accessibility of public transport systems. "Security measures at the railway station are adequate" (Mean = 3.19, Rank = 2nd) also received strong approval, reflecting passenger confidence in safety protocols. This supports previous findings by³¹, which emphasized that effective security is critical to sustaining rail ridership, particularly in regions prone to insecurity. "Train services are affordable for most residents" (Mean = 3.17, Rank = 3rd) further underscores the cost-effectiveness of rail travel, making it a viable alternative to more expensive or unreliable road transport options, especially for low- and middle-income commuters. "The train stations are well-maintained and clean" (Mean = 2.75) and "The staff at the train station are courteous and helpful" (Mean = 2.72) reflect positively on basic service quality and customer service, contributing to the overall commuter experience. Despite these strengths, five out of ten items were rated below the acceptable threshold of 2.5, suggesting significant areas of concern: "Train services are regular and adhere to schedule" (Mean = 2.20, Rank = 9th) and "I am generally satisfied with the quality of railway services provided" (Mean = 2.17, Rank = 10th) ranked lowest.

Table 5: General Perception and Recommendations

	General Perception & Recommendation	SA	A	D	SD	Total	SWV	Mean	Remarks	Rank	x-x̄	(x-x̄) ²
		4	3	2	1							
1.	Railway transportation plays a vital role in national development	540	303	80	17	293	940	3.21	Accepted	3 rd	0.357	0.1274
2.	Government investment in rail infrastructure is a worthwhile priority	504	327	64	26	293	921	3.14	Accepted	5 th	0.287	0.0823
3.	The railway system in Nigeria needs significant improvement	540	345	62	12	293	959	3.27	Accepted	1 st	0.417	0.1739
4.	Public awareness about railway services should be increased.	472	315	100	20	293	907	3.10	Accepted	6 th	0.247	0.0610
5.	Stakeholder engagement is necessary for better railway service delivery.	480	297	106	21	293	904	3.09	Accepted	7 th	0.237	0.0562
6.	I believe railway transportation should be expanded to more regions	484	294	94	27	293	899	3.10	Accepted	8 th	0.247	0.0610
7	More modern technology should be incorporated into the Nigerian railway system	500	357	84	7	293	948	3.24	Accepted	2 nd	0.387	0.1498
8	Private sector involvement would improve railway efficiency and sustainability.	496	342	62	24	293	924	3.15	Accepted	4 th	0.297	0.0882
9	My overall experience with railway services has been positive.	384	180	170	52	293	786	2.68	Accepted	9 th	-0.173	0.0299
10	I would recommend railway transportation to others for travel or business	312	195	178	61	293	746	2.55	Accepted	10 th	-0.303	0.0918
								28.53				0.9215
								2.853				

Table 5 explores the general public perception and recommendations regarding railway transportation in Nigeria. The results, show an overall grand mean of 2.85, indicating a strong consensus on the importance and necessity for improvement of the railway sector. All items in this category were "Accepted" (Mean ≥ 2.5), reflecting widespread approval and forward-looking recommendations to enhance the system. The highest-rated statement was: "The railway system in Nigeria needs significant improvement" (Mean = 3.27, Rank = 1st).

This highlights passenger frustration with inconsistency in service delivery, such as delays and cancellations. Timeliness and reliability are key indicators of transport efficiency, and persistent shortcomings in these areas can erode user trust³⁰. "Railway infrastructure (tracks, bridges, terminals) is modern and reliable" (Mean = 2.30) and "There is adequate signage and information at the train station" (Mean = 2.22) received poor evaluations. These findings imply that although front-end services (like ticketing and security) may function well, underlying infrastructure and station layout require significant upgrades. As³² note, the sustainability of rail systems in developing countries depends on regular infrastructure rehabilitation and technological innovation. "The railway coaches are comfortable and in good condition" (Mean = 2.44, Rank = 6th) also fell below expectations, indicating the need for improved rolling stock standards to ensure comfort and appeal, especially for long-distance passengers. The variance in perceptions ($\sum(x-\bar{x})^2 = 1.6619$) and mean deviation (2.637) indicate moderate inconsistency among respondents, reflecting differing levels of exposure to or satisfaction with specific services. This could be due to disparities in service quality across routes or stations, highlighting the need for standardization and system-wide quality control. While the study reveals positive perceptions of some aspects of railway service, particularly in terms of affordability, security, and ease of access, it also exposes critical service delivery and infrastructure gaps. These issues must be addressed to build public confidence and ensure that railway transportation becomes a reliable pillar for national mobility and socio-economic transformation. Investments in infrastructure modernization, coach rehabilitation, improved scheduling, and information systems are crucial to enhancing overall service satisfaction and system sustainability.

This finding underscores a public demand for modernization, efficiency, and reliability, aligning with previous research that points to outdated infrastructure and inconsistent service delivery as critical challenges facing Nigeria's railway sector³². Respondents clearly view the existing railway infrastructure as underperforming and ripe for reform. The second-highest score was recorded by the statement: "More modern technology should be incorporated into the Nigerian railway system" (Mean = 3.24, Rank = 2nd).

This shows strong support for innovation, such as digital ticketing, GPS-tracked trains, smart scheduling, and improved safety systems. As³⁴ emphasize, technological advancement is a key driver of rail system efficiency and customer satisfaction. “Railway transportation plays a vital role in national development” (Mean = 3.21, Rank = 3rd) and “Private sector involvement would improve railway efficiency and sustainability” (Mean = 3.15, Rank = 4th) also received strong backing. These perceptions align with global best practices where public-private partnerships (PPPs) and investment in railway infrastructure have been shown to improve productivity, reduce logistics costs, and spur economic growth^{31,35}.

Statements such as “Government investment in rail infrastructure is a worthwhile priority” (Mean = 3.14), “Public awareness about railway services should be increased” (Mean = 3.10), and “Stakeholder engagement is necessary for better railway service delivery” (Mean = 3.09) reflect an understanding among respondents that policy, communication, and community participation are essential to the success of railway modernization. These insights suggest that beyond physical infrastructure, soft systems such as awareness campaigns, user feedback, and governance transparency are crucial components for sustainable development in the sector.

Respondents also supported the geographical expansion of the railway network, as shown in the statement “Railway transportation should be expanded to more regions” (Mean = 3.10, Rank = 8th). Nigeria’s rail system remains limited in its reach, and its extension is essential for inclusive national connectivity, particularly to underserved and rural regions³⁰.

Despite the critical feedback, respondents demonstrated a generally favorable personal experience, with “My overall experience with railway services has been positive” (Mean = 2.68) and “I would recommend railway transportation to others” (Mean = 2.55), though these had the lowest rankings (9th and 10th, respectively). These results suggest a mixed level of satisfaction, likely influenced by variations in service quality, delays, and infrastructure disparities across locations. The relatively low mean for recommendations highlights the need to bridge the gap between perceived potential and actual user experience. The total variance ($\sum(x-\bar{x})^2 = 0.9215$) and grand mean of 2.85 indicate a high level of agreement among respondents on the relevance, improvement needs, and strategic directions for railway development in Nigeria. The responses show both support for current efforts and urgency for strategic, inclusive, and technologically driven reforms.

Overall, the findings affirm that railway transportation is seen as a critical driver of national development, but its current implementation in Nigeria falls short of public expectations. There is robust support for technological innovation, government and private sector investment, network expansion, and increased public engagement. These insights are invaluable for policymakers, investors, and planners as they redesign the future of rail transport in Nigeria to meet global standards and national needs.

Correlation Analysis

The primary objective was to measure the strength and direction of the linear relationship between Railway Infrastructure Investment (RII): Quality of tracks, frequency of train services, funding, modernization, and Economic Development (ED): job creation, trade facilitation, business expansion, and income level.

Hypothesis:

H₀ (null): There is no significant correlation between railway infrastructure investment and economic development.
Variable X = Average score for Railway Infrastructure Investment (RII)
Variable Y = Average score for Economic Development (ED)
Sample size n = 293

Variables	Pearson’s r	p-value	Strength of Correlation
Investment in Rail × Economic Growth	0.72	<0.001	Strong Positive Correlation
Technological Adoption × User Satisfaction	0.65	<0.01	Moderate Positive Correlation
Awareness × Railway Usage	0.51	0.015	Moderate Positive Correlation

Interpretation and Discussion

Investment in Rail × Economic Growth (r = 0.72, p < 0.001)
Strength: This is a strong positive correlation (0.70–0.89 range).
Direction: As investment in railway infrastructure increases, economic development improves.
Significance: The p-value (<0.001) indicates the result is highly statistically significant, meaning there’s a very low probability that this relationship is due to chance.
This supports the hypothesis that railway infrastructure is a critical enabler of economic activity. Investment in rail enhances logistics, reduces transport costs, improves regional trade, and stimulates job creation in construction, services, and supply chains.

Technological Adoption × User Satisfaction (r = 0.65, p < 0.01)
This shows a moderate to strong positive relationship.
Suggests that the adoption of modern technology in railway operations, like digital ticketing, real-time tracking, and safety systems, enhances user satisfaction.
Again, the result is statistically significant and relevant for strategic planning.

Awareness × Railway Usage (r = 0.51, p = 0.015)
A moderate positive correlation.
Indicates that higher public awareness (through campaigns, education, or media) is associated with increased railway usage. Statistically significant (p < 0.05), meaning awareness programs can be used to boost ridership and justify further investment.

These findings have several practical implications:

- Policy Focus: Sustained and well-directed government investment in railway infrastructure can drive substantial socio-economic benefits.
- Technology Integration: Investment should include technological modernization, not just physical infrastructure.
- Public Awareness: Initiatives aimed at increasing public awareness can improve ridership, ensure cost recovery, and optimize usage of railway services.

The study provides robust statistical evidence that railway infrastructure investment has a strong and significant positive impact on economic development in Nigeria (r = 0.72, p < .001). Additionally, technological adoption and awareness are also positively linked to satisfaction and usage. These insights reinforce the necessity of continued infrastructure development, modernization, and stakeholder engagement in the transport sector.

Regression Analysis

The goal of this analysis is to determine the extent to which the independent variables:

X₁ = Government Investment

X₂ = Public Awareness

X₃ = Technological Innovation, can predict the dependent variable:

Y = Economic Development

Multiple Linear Regression Model: $Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \epsilon$

Where:

Y = Economic Development

X₁ = Government Investment

X₂ = Public Awareness

X₃ = Technological Innovation

ε = Error term

Predictor Variable	β (Beta Coefficient)	t-value	p-value	Interpretation
Government Investment	0.58	5.42	0.000	Significant positive predictor
Public Awareness	0.29	3.14	0.002	Significant positive predictor
Technology Adoption	0.35	3.72	0.001	Significant positive predictor

Model Fit Summary:

R² = 0.65 (the three predictors explain 65% of the variance in economic development).

F (3, 289) = 65.12, p < 0.001 (The overall model is statistically significant, meaning the predictors as a group reliably forecast economic development).

Interpretation and Discussion

Government Investment (β = 0.58, p = 0.000)

Most influential predictor.

A one-unit increase in investment (e.g., better rail infrastructure, funding, modern stations) leads to a 0.58 unit increase in economic development, assuming other variables are held constant.

Strong policy implication: Expanding railway infrastructure and maintenance yields measurable economic returns.

Public Awareness (β = 0.29, p = 0.002)

Significant, though relatively weaker predictor.

Indicates that engaging the public, raising awareness about railway services, and promoting usage has a positive impact on economic outcomes (such as increased rail-based commerce, employment, etc.).

Implies the need for public sensitization campaigns and outreach.

Technology Adoption (β = 0.35, p = 0.001)

A significant predictor with moderate impact.

Suggests that investing in modern technologies (ticketing systems, digital monitoring, real-time updates) enhances efficiency, passenger satisfaction, and indirectly supports economic growth.

These findings have several practical implications:

- Government investment should be prioritized as it yields the highest direct impact on socio-economic development.
- Technological innovation and public awareness should be seen as complementary drivers of railway performance and economic benefit.

- The high R² of 0.65 suggests that this model is substantively strong; it accounts for two-thirds of the variation in economic development, which is rare in social science research.

The regression model confirms that government investment in railways is the strongest driver of economic development, while public awareness and technological adoption are also significant contributors. These findings reinforce the importance of a multi-dimensional approach to infrastructure development, one that combines funding, innovation, and community engagement to achieve long-term economic growth.

Conclusion

There exists a strong and statistically significant positive correlation between railway infrastructure investment and economic development (Pearson's r = 0.72, p < 0.001). This suggests that improvements in rail infrastructure, such as track quality, funding, and modernization, are strongly associated with increased economic activities, including trade facilitation, job creation, and income growth. Multiple regression analysis revealed that government investment, public awareness, and technology adoption are all significant positive predictors of economic development, with government investment having the strongest influence (β = 0.58, p < 0.001). The regression model explained 65% (R² = 0.65) of the variance in economic development, confirming the practical significance of these variables. Investment in railway transportation significantly contributes to national economic expansion by enhancing connectivity, reducing transportation costs, promoting industrialization, and boosting regional development. The revitalization and modernization of rail services are therefore essential for sustainable national growth. Public awareness of railway services also contributes to their effective utilization. Increased sensitization and accessibility can lead to greater usage, further stimulating economic activities around railway corridors. Adoption of modern railway technologies improves operational efficiency, user satisfaction, and safety. This, in turn, fosters public trust and increases reliance on rail as a viable mode of transport. Railway transportation in Nigeria holds tremendous potential as a catalyst for socio-economic transformation. This study provides empirical evidence that increased investment, enhanced public engagement, and the integration of technology in rail systems can significantly stimulate economic growth. Thus, for Nigeria to realize sustainable development, railway infrastructure must be prioritized as a core component of the national economic strategy.

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