

Integrated Economies and Policy Insights

<https://iepi.cultechpub.com/iepi>

Cultech Publishing

Article

Comparative Analysis of Transportation Infrastructure and Third-Party Insurance on Economic Growth in Northern Nigeria: A Cross-Sectional Analysis

Adewale E. Adegoriola^{1,*}, Najimu A. Nafiu²

¹Department of Economics, Federal University Lafia, Nasarawa State, Nigeria

²Department of Actuarial Science, Federal University Dutse, Jigawa State, Nigeria

*Corresponding author: Adewale E. Adegoriola, adegoriola@gmail.com

Abstract

This study investigated the relationships between socio-economic characteristics, transportation infrastructure, third-party insurance uptake, and economic growth in Northern Nigeria by adopting a quantitative cross-sectional design. Data were collected from Lafia and Dutse through questionnaires and secondary sources from the Central Bank of Nigeria (CBN) Statistical Bulletin and the National Insurance Commission (NAICOM). A total of 136 valid responses were analyzed using descriptive statistics, multiple regression, and Spearman's rank correlation after normality tests indicated mixed data distribution. The findings showed that socio-economic characteristics had a weak and statistically insignificant relationship with transportation infrastructure, suggesting that infrastructure development is mainly influenced by institutional and structural factors than individual attributes. Conversely, socio-economic variables, particularly age and gender, significantly influenced third-party insurance uptake, with males and younger respondents more likely to purchase insurance. The gross domestic products (GDP) regression model revealed that transportation services significantly contribute to economic growth, although multicollinearity reduced the significance of some predictors. Transportation infrastructure and third-party insurance were also found to operate independently, influencing economic growth through different mechanisms. The study concludes that transportation infrastructure is a stronger driver of economic growth, while insurance uptake is largely shaped by demographic and behavioral factors. It recommends that all levels of government should elevate the construction investments in the infrastructural projects. In addition, the policymaker should have adopted broader indicators in order to evaluate transportation performance. Government agencies and operators across all levels should mainly focus on the improvement of road safety, operational efficiency and culture maintenance, traffic management services, and integrating different modes of transport operations. The economic players of transportation namely insurance regulators and companies, transport authorities should have intensified public awareness campaigns. Government agencies that are responsible for road transport and insurance regulatory supervision should have improved the system of monitoring transport operations. Government should have improved transportation logistics, commercial infrastructures and market accessibility that will facilitate and expand internal, and regional trading businesses in Northern Nigeria.

Keywords

Transportation, Infrastructure, Insurance, Macroeconomic factors, Economic growth, A cross-section model

Article History

Received: 22 December 2025

Revised: 12 August 2026

Accepted: 21 August 2026

Available Online: 04 September 2026

Copyright

© 2026 by the authors. This article is published by the Cultech Publishing Sdn. Bhd. under the terms of Creative Commons Attribution 4.0 International License (CC BY 4.0): <https://creativecommons.org/licenses/by/4.0/>

1. Introduction

In developed economies, transportation infrastructure has facilitated the delivery of goods and services across other industries by actively enabling the movement of people and materials through land, water and air transportation [1]. In addition, infrastructural investment has played a vital role in global development [2], through which the facilitation of production activities and stimulation of economic growth as well as reduction in transaction and trade expenditures [3]. Meanwhile, the Sustainable Development Goals (SDGs) has indicated transport infrastructure as one of the vital force for the development of sustainability through the significance of third-party insurance [4]. In addition, Fedderke and Bogetic [5] opined that economic growth would have positively been affected if infrastructure was regarded as a positive input to production process, other inputs, stimulation of factor accumulation, aggregate demand booster, and guideline to industrial policy for private-public sectors to intentionally make investment decisions.

Although, the outcome of Nigerian economy has unfavorably increased the rate of unemployment due to the lack of transportation infrastructure adequacy and low third-party insurance penetration as a bottleneck that suppresses economic outcome in the northern region [6]. The motorists' activities have been regulated from the Road Traffic Liability risks, which attributed for the carelessness of vehicle users on the road that accidentally causes loss of bodily injury or damage to property or other valuable assets alongside the road [6]. Despite the transportation infrastructures put in place in accordance with industrial revolution and innovative technology as well as legally institutional frameworks for controllable safety and mitigating mechanisms for healthy environment and transportation fatalities from the pedestrians, social and economic problematic challenges have confronted the developmental sustainability of the frameworks, and high logistics costs that affect the adequacy transport networks to rural production areas and urban markets [7]. Meanwhile, rapidly resilient urbanization in most of developing and developed nations has tremendously presented challenges to the transportation infrastructural system in terms of accessible mobility for sustainable environment and security or infrastructure challenges [8].

The scholarly research papers have been analyzed presently the comparative examination of transportation infrastructure and third-party insurance measurement. The analyzed indicators that influence transportation infrastructure and third-party insurance [6,8,9] in which the major constraint for comparison of transportation infrastructure and third-party insurance analytic expression is the main discourse in creating the transportation infrastructure and third-party insurance component model. Nevertheless, the peculiar objectives are stated below.

- i. To analyze the effect of socio-economic information on transportation infrastructure and third-party insurance in Lafia and Dutse metropolis, Nigeria.
- ii. To identify the relationship between transportation infrastructure and third-party insurance in Lafia and Dutse metropolis, Nigeria
- iii. To examine the effect of macroeconomic factors on the gross domestic products (GDP) in Nigeria.

Because of this, the study is reviewing on the relevant literatures of transportation infrastructure and third-party insurance to analyze the hypothetical statements of the following:

H0₁: The insurance policy for thirty party will not influence the infrastructure of transportation at a particular entity and vice versa.

H0₂: There is no significant association between macroeconomic factors and GDP in Nigeria.

Generally, the researchers observe the research gaps based on the previously recent authors and scholars' examinations.

2. Literature Review

The efficiency of infrastructural in any socio-economic development has enhanced the factors of both public and private production [10], in which the extractive, secondary and tertiary productivity have commensurate from the basic needs for services as the socio-infrastructural livelihoods [11]. The investment in transportation infrastructure has not only brought socio-economic benefit but also enhanced the life quality, intermediate production inflow, rural empowerment increment and interconnectivity within rural and urban environments [12]. Meanwhile, the integration of transportation infrastructure and third-party insurance has deeply rooted the engagement of international trade and ports services as one of the Nigerian businesses' cornerstones [13].

2.1 Conceptual Clarifications

2.1.1 Independent Variables

2.1.1.1 Transportation

Transportation is a basic element for modern development, which there is variability in contextual description. Transportation describes as infrastructural systemic operations to enhance the movement of human beings and cargoes from point of departure to the destination [14]. That is, transportation is the movement of human and products from the

loading point to the destination point, using infrastructural systemic technologies namely vehicles, energy and infrastructure, as well as effort and time for effective and efficient outputs [15]. Transportation plays a critical role in facilitating economic activities, social wellbeing, and population cohesion. By providing efficient and affordable transportation options, transportation infrastructure can stimulate economic growth, reduce living costs, enhance market accessibility, and foster competitiveness among local businesses. Moreover, improved transport infrastructure enables entrepreneurs to seamlessly transport goods and services to and from markets, further boosting economic vitality. In Nigeria, the sector of transportation is categorically divided into five different subsectors namely road, rail and pipelines transportation; international transport (air and water) and other services rendered under transportation [16] as major modes of transporting human and products namely land (road and rail), water and air.

2.1.1.2 Transportation Infrastructure

One of the driving mechanisms for moving any developing and developed economy is infrastructural amenities [11], which facilitates the integration of production enabling efficiency, adequate distribution and human connectivity within the transportation activities. Transportation infrastructure is particularly and essentially vital in facilitating the human capital and economy of any developed nations [13], which third party motor insurance has well been considering as the community needs for the local content as a result of frequent accidental losses and bodily injuries and death arising from transportation media [17]. More so, the transportation infrastructure development is enormously established as a critical parameter in promoting social and economic health of the populace, especially in rural-urban environment in order to profound influence on the life quality and local content economy [18]. The development of transportation infrastructure has been highlighted as the reaching beneficial in term of transportation costs reduction, market access enhancement, and workers' connectivity improvement, which lead to economic boastfulness and poverty reduction [19].

In addition, transportation infrastructure sustainability in most economic activities is mostly significant in all sectors as a deliberation, which third party insurance as a component of economic growth has indirectly played a crucial role to boost transportation system through the servicing mode namely land, maritime adventure and air. On the other side of the coin, a weakened transportation industrial system outcome as failed opportunities. To have an establishment is therefore an efficiency and effectiveness of transport industry in Nigerian economy that can integrate rapid third-party insurance and economic growth [16]. More so, there is rapidly growth in the demand and supply of public transport servicing activities as result of growth in population and urban center [20]. In most of servicing industries, road transportation has the most frequently arranged and used in Nigeria [21] followed sequentially by others namely water, rail and air. In fact, the study in Ref. [22] from recent literatures has revealed that motor transportation system has efficiently added as the most prominent outcome of the transportation industry in most countries especially Nigeria and other West, East and North African nations [21].

Furthermore, transportation infrastructure has constituted to be publicly capitalized productivity that embraces efficient economy through travelling-period reduction, reducing logistics costing, labor mobility facilitation, responsiveness to market integrating improvement, private investment stimulation. These techniques must have consistently with Theory of Endogenous Growth that postulates the multiplier effect of transportation infrastructure investment, which generates earnings returns increment from optimum productive improvements [23,24]. Based on the above submission, the incorporation of New Economic Geography Theory has also demonstrated the transportation network efficiency, which partially decreases transactional costs, promote adequately the regional specialization, facilitation of agglomerate industry, access improvement to largely established markets [25]. In fact, the relevancy of theoretical aspect is individually particular to Northern-Nigeria, whereby there is substantively disparities in qualitative road amenities and accessibility in transportation networks, which ought to have contributed significantly to unequal regionally economic growth and development.

2.1.1.3 Third-Party Insurance

Third party insurance describes as a coverage to the proposer, policyholder or insured person for liability covered against the risks and damages caused to third parties that are not part of the insurance contract as a result of intentional action [26]. This coverage is making provisions for the property damage liability, bodily injury liability and collision of vehicle as well as uninsured motorist liability [27]. More so, third-party liability insurance is a policy covered bought from a professional trained insurance officer for the purpose of protecting the insured against claims accidentally made by a third party for damage of property or injury from part(s) of body due to insured's negligent actions [28]. Third-party insurance is an insurance policy designed to provide coverage or cover for property damage or bodily injury caused to someone by the insured [27].

However, the transfer of risks has been the major objective of insurance in order to protect the economic players especially individuals and organizations against financially economic losses and damages emanating from accidentally road traffic occurrence [29]. In addition, financial stability improvement has also set out by insurance in order to reduce transportation activities associated with uncertainties, which this encourages commercialized institutional investment. According to Ref. [30], this thereby indirectly contributes adequate compensation for accidentally involved persons and also decreasing costs of litigation from third parties and genuine insured, which this indirectly contributes to higher premium penetration for mobilization and capital accumulation.

2.1.2 Control Variable

The socio-economic information is otherwise known as socioeconomic factors that encompass a large measure of social and economic variables, which affect the economic participants' wellbeing. In most cases, the variable factors serve as the determinants in any activities, which are age distribution, gender status, occupation, educational status, social status, employment, living conditions. The influential significance of socioeconomic factors can never be overemphasized in terms of how it affects researchers, policymakers and social planner as a result of the accessibility to resourceful endowments, risk exposures and pursuance of social mobility. In actual implications, income levels have served as the most determining factor of socioeconomic variable that essentially influences the following necessities namely food, shelter, health, clothing and education [31].

2.1.3 Intervening Variables

2.1.3.1 Transport Services

Transport services is described as a commercialized freight and passengers' movement using land (road and rail), air and water as different transportation modes in order to facilitate socio-economic operational activities, which these have constituted a vital aspect of the transport industry so that enhancement for efficient distribution of labor mobility, products, and markets accessibility as well as necessity services rendering [32]. Transport services has always stimulating the efficiency of labor market for workers' mobility improvement and expansion and accessibility for job opportunities, which indirectly contribute to the development of human capital and long-run economic growth [33]. On the other ends, lack of adequate transport services leads to operational costs increment, which this decreases overall productive economy [34].

2.1.3.2 Government Expenditure

Government expenditure is best described as the total spending expended through government administrative authorities in order to create public projects, development of financial infrastructure, supporting programs for socio-economic welfare, maintenance of public administration, and stimulation of economic activities [35]. However, the theory of Keynesian economics opined that government expenditure is one of the primary tools of fiscal policy used to stimulate aggregate demand especially the low private sector investment in order to boost outputs level, rate of employment, national income growth [36]. In fact, it is a measure adopted in stimulating income distribution, allocation of resources and aggregate demand as well as development of long-run economy [35]. Meanwhile, the contribution of government expenditure to economic growth is vital in relations to human capital improvement, enhancement of workers' skillful and health status, as well as operational productivity as a multiplier effect on higher level of labor efficiency and economic outcome increased [37].

2.1.3.3 Insurance Factors

Insurance factors characterize as the institutional, financial and operational settings of the insurance industry that effect their capability to embrace economic operations in order to improve and promote sustainable economic growth and development through gross premium income, claims payment settlement, and underwriting performance and insurance penetration through reinsurance arrangements, premium investment and regulatory compliance effectiveness [30]. Higher insurance penetration is a significant indicator for adequate financial protection within the economy that is holistically related with improved investment, sound financial intermediation, and favorable macroeconomic stability [38]. In addition, this also provides long-run capital that embraces large infrastructural projects development, business operational expansion and commercial enterprises, and economic growth and development [39] as well as supports transport systems distinctive away from excessive exposure of financial risk [40], and enhances long-term economic development [41].

2.1.3.4 Education Access

Education accessibility is described as the individual opportunities to gain quality, affordable and equitable educational skills without considering their gender, socioeconomic background and regional and geographic settlement in terms of enrolment, attendance, rates of completion, learning resources availability and proximity to educational institutes in order to drive as basic factor for the development of human capital as well as long-run economic growth [42,43]. Meanwhile, the Theory of Human Capital describes education as an investment that boosts the productive capacity of workers in order to have improved knowledge, technical know-how, problem-solving capability and adaptability to technological change [42]. Education access improves job opportunities through employability and occupational mobility in order to have improved and increased production processes and competitiveness in internal and foreign markets [44,45].

2.1.3.5 Trading Business

Trading business is referred to as the activities involved of commercial enterprises in accordance with marketing i.e. buying, selling and distribution of products within internal and across international trade, which consists of middlemen trading (Wholesaling and retailing), importing and exporting activities, distribution and logistics networks, and commercialized exchanged activities that serve as linkage between the channels of distribution namely producers, intermediaries and consumers [46]. The studied theories of classical and modern trade explain the commercial exchange in order to enable nations and regional areas in specializing the goods and services production so that comparative advantages possessed improve resource allocation, productivity increased and economic growth stimulation [25,47]. Consequently, investment in transportation infrastructure improves the trading businesses competitiveness that directly adds to economic growth [32,48], which stimulate aggregate demand and supply, reinforcing economic development from multiplier influence [49].

2.1.3.6 Government Taxes

Government taxes is described as compulsorily mandatory financial payments imposed on economic players (individuals, households, and trading businesses by government authorities in order to generate government revenue in financing public projects and constructions as well as socioeconomic welfare and government administrative activities. Likewise, these are basic tools of fiscal policy created for public projects, development of financial infrastructure, supporting programs for socio-economic welfare, maintenance of public administration, and stimulation of economic activities [35]. This instrument adds to economic growth in strengthening publicly institutional corporation, and promotion of macroeconomic stability, which these create a predictable trading environment, encouraging entrepreneurship, internal and international investment [50].

2.1.4 Economic Growth

Economic growth refers to the sustained increase in the productive capacity of an economy over time and is commonly measured by the growth rate of real GDP, which adjusts for changes in price levels [51]. GDP as an indicator that is used to measure economic performance, capturing changes in production, consumption, investment, government expenditure, and net exports, which are the principal components of aggregate demand.

Gross Domestic Product (GDP) describes as “the total financially monetary value of all final products (goods and services) produced within the geographical boundaries of a nation or region during a specified period, usually one year”. This is an economic instrument used to measure the performance of economic growth of a particular country [52], which serve as a reflection of aggregate output deduced by all indicators of economy namely agriculture, manufacturing, transportation, construction, trade, finance, and services in order to measure economic growth and development and macroeconomic policy [51].

2.2 Conceptual Framework

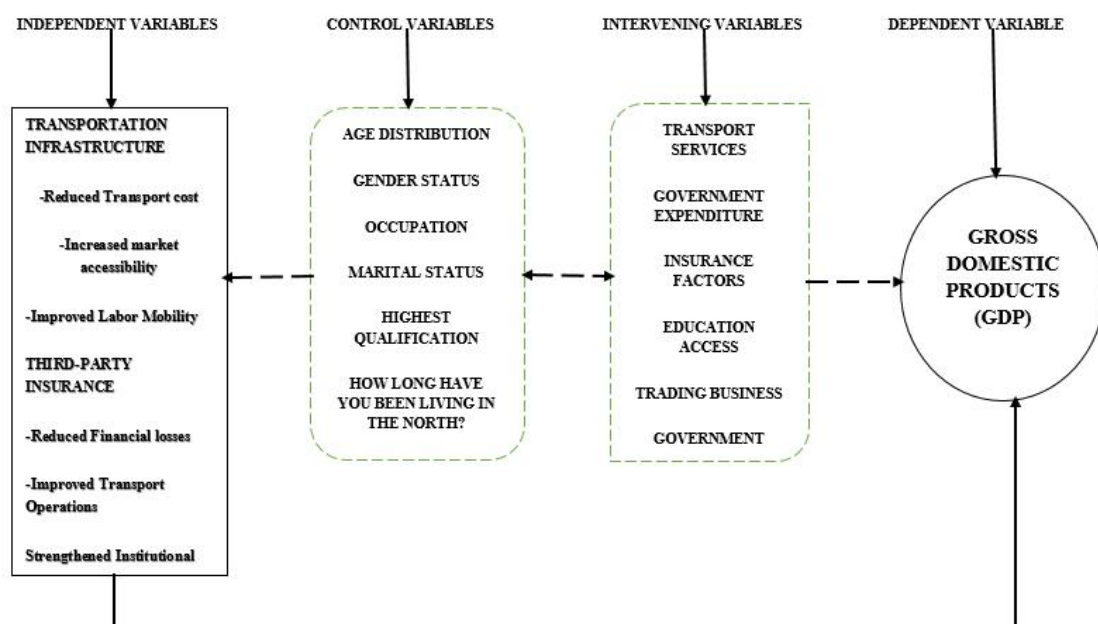


Figure 1. Conceptual framework of comparative analysis of transportation infrastructure and third-party insurance on economic growth in Northern-Nigeria: A cross-sectional analysis. Source: Authors' Design, 2026.

2.3 Theoretical Review

2.3.1 Transportation Infrastructure Development Theory

This theory examines the role of transportation infrastructure as comparison with third party insurance as an economic development. Moreover, how it can affect third-party insurance markets. Theoretically, transportation infrastructure has influenced to draw from the theories of classically urbanized economic and newly geographical economy. These theories indicate that infrastructural investments will positively influence regionally received output by the reduction of travel and operational costs, enhancement of accessibility, mitigation of traffic congestion, creation of employment opportunity resilience, acceleration for speeding travels, facilitation of local and external trade, and encouragement of invested inputs [53]. Based on this, the efficiency of goods and people movement, trade expansion and activities for higher economy have made risk covers essentially improved, which enhances third-party motor insurance to be mandatorily purchased in order to build transportation infrastructure as a useful indicator for insurance market, which all leads to increase in economic growth penetration. In addition, the indirectly and equally significant consequences have influenced the productivity, while a prospering transport network has reduced the transactional costs, in order to optimize the resourcefulness utilization, and fostering agglomeration consequences [54]. The perspective of economic growth as a multiplier effect from third-party insurance and transportation infrastructure have played a stabilizing role for the reduction of financial uncertainty through risk transferring mechanisms, and protections of individuals and commercialized enterprises from large accidental damages and losses, as well as building confidence in transport-related activities engagement in order to encourage economic growth reinforcement through entrepreneurship, investment, and trade.

More so, this theory postulates that the transportation system investment is an indicator for a formative production for public capital project in order to embrace economic sustainable performance through transporting and transactional cost reduction, markets accessibility improvement, facilitation of efficient products movement and informative communication. Meanwhile, the theory was established in infrastructure economic, New Economic Geography and Endogenous Theory as collective theories, which opines the infrastructure of transportation should generate external forces that improve productive efforts and long-run economic growth and development stimulation [23-25]. From the perspectives of economists, the integration of regional settlement ins promoted by transportation infrastructure, which serves production linkage centers for markets consumption in order to lower logistics expenditures, private investment encouragement, facilitation of industrial agglomeration, as well as expansions of internal and international trading environments, improving business competitiveness and economic development sustainability [55].

Meanwhile, the provisions of the theory constitute significantly conceptualized linkages with the insurance of third-party especially motor vehicle insurance in terms of transportation infrastructure expansion increment through motor vehicle ownership, freight and passengers' movement and commercialized transport logistics. Effectively, accidentally fortuitous risks and legal costs are the multiplier results of increment for greater traffic density and utilization road usage as an exposure to all road users. Naturally, the development raises an alarming demand for compulsorily mandatory third-party motor insurance that constitutionally establishes as a financial risk-transfer technique for all transportation operators, owners of motor-vehicles and passengers, as well as third-parties directly and indirectly affected by contingencies of road accidents.

In Northern Nigerian context, road infrastructure improvements serve as an expectation in stimulating commercialized agriculture, inter-state trading and manufacturing activities, and expansion of servicing sectors. In actual sense for increased transport activities, compulsorily mandatory third party insurance increasingly become significant in giving protection on economic intermediaries against financial losses from accidentally related incidents in order to support uninterrupted operations from commercialized transportation. Furthermore, GDP is directly influenced by transportation infrastructure and third party insurance patronage as well as transportation sector through enhanced productivity, and strengthened insurance penetration growth as well as financial security respectively, in which progression for physical infrastructure becomes an essentially institutional complementary establishment, which builds third party insurance in supporting economic growth sustainability.

2.3.2 Insurance Economic and Risk Management Theory

The theory of insurance economic and risk management argues the assertion that any compulsorily mandatory third-party automobile vehicle insurance policy should have reduced the financial uncertainty related with accidentally road traffic occurrence in order to shield individual households and organized businesses against fortuitous losses and liabilities, which this will enhance the reactivity for investment trust and confidence, as well as indirectly contribute to productive economy continuity through commercialized transportation activities [29,30]. In particular, the theory of risk management explains how third-party insurance can help manage risks associated with transportation infrastructure development and usage. That is, different risk management theories have viewed in explaining the relationship between transportation and third-party insurance so that the credit risk (CR) friction and imperfections of market can assist to hedge the risk associated with transportation infrastructure in accordance with how third-party insurance is being operated [56]. The deduction of risk, finance and investment channels has created credit frictions so that transport projects can be financed because of the frequent uncertainty and the potentially severity losses. Based on this, third-

party insurance assists resolving the challenges of frequency and severity of potential losses through risk mechanisms namely transferring, hedging, sourcing and managing apparent and inherent risks of transport operators and infrastructure users especially when taking insurance as the best alternative options of risk mechanisms. Meanwhile, the main predictive operation is the credit risk rationing in revealing the mitigation to have hedged the CR rationing of transportation infrastructure. Even, financial constraints correlate to an enterprises' need in order to fund for future investments of transportation infrastructure on how third-party insurance will have managed the risk associated [57]. As a result, firms facing financial constraints are better able to secure funding for transportation infrastructure investments, which affects economic growth. In all, transportation infrastructure and insurance drive economic growth, despite the third-party insurance firms the economic growth to be potentially financeable and resilient through credit constraints easiness and risk management.

The study in Ref. [29] established that insurance use to enable economic players to have transferred certain financial losses to insurers from pool of risks, which are thereby used to encourage investment productivity within economic activities because of the avoidance of financial loss uncertainty. In the transportation systemic view compulsorily mandatory vehicle insurance constitutes institutional and economic features, where the protection of transport operators and policyholders are economically performed against accidental liabilities emanating from road transport accidents in order to ensure and pay damages to the involved victims. According to Ref. [30], this thereby indirectly and institutionally contributes adequate compensation for accidentally involved persons and also decreasing costs of litigation from third parties and genuine insured, which this indirectly contributes to higher premium penetration for mobilization and capital accumulation. In addition to the theory, transportation infrastructure development has inevitably increased the operational risks related with higher volumes of traffic accidents, increment in ownership of vehicles, mobility of passenger and freight, which requires risk management processes of the potential and existing risks. In other word, catastrophic financial losses can be manageable assessed through insurance premiums management because third party insurance serves as the main effectiveness of risk-transfer mechanism in order to improve the transportation users and organized businesses' financial stability [40]. Insurance as financial intermediation has contributed macroeconomic growth and development through investment in government bonds, project infrastructures, and corporate financial programs, as well as capital market seminars, which increase capital formation, and support long-run economic development [38,39]. Consequently, the integrated relationship between transportation infrastructure and third-party insurance is however established as a complementary evidence instead of independent view. Likewise, increased in transportation infrastructure expansion involves transportation activities and risk exposure from accidental occurrence. Meanwhile, financial effects from the inherent and apparent risks are reduced because of the purchase of third party insurance, which this often improves continuity in business operation, entrepreneurship encouragement, and investment facilitation as well as productivity improvement across the components of economy.

2.3.3 Unbalanced Growth Theory

This theory was propounded by Hirschma, Rostow, Fleming, Streeten, Singer, and Sheehan as an economic development strategy adopted by underdeveloped and developing countries in order to adequately stress on the investment need in relation to strategic industries of the economy. Meanwhile, other sectors would automatically spring up their development through their multiplier linkage effects. Generally, the theory is related with Hirschman with a complete theoretical formulation of the strategy in respect with macroeconomic variables. Meier and Baldwin opined that concentration should be focused on one external economies to the existing industry that could complement demand for supplementary products (goods and services) in order to improve the levels of gross national income (GNI) per capita and GNI per capita growth, large income equality and poverty reduction, high levels of productivity, great dependence on agriculture, a backward industrial structure, a high proportion of consumption and high savings, moderate rates of population growth and dependency burdens, low unemployment and underemployment, technological forwardness through capital goods rather than consumer goods [58].

From the deduction of this theory, transportation infrastructure serves as the strategic leading sectors, whereby government prudently concentrates investment in transport means, which lead to demand for construction materials supplied and labor engagement as backward linkages and logistics improvement for agricultural produces, manufacturing processes and trade services as forward linkages. These alignments induce demand for complementary goods and services, where third-party insurance takes place to reduce the element risk involved. Under this theory, transportation infrastructure serves as the baseline for economic growth through which, the third-party insurance emerges to support and sustain the economic growth as the main linkage industry.

As Hirschman postulated the Unbalanced Growth Theory, which he argued the achievement of developing economies in order to have fastened the structural transformation is to have strategically concentrated much more on the publicly scarce resources through the possessed linkage of strongest forward and backward sectors instead of being evenly distributed across all economic components. Significantly, the support of transportation infrastructure has stood as one of the top sectors that positively affects other sectors (production, distribution, trade, agriculture, manufacturing, mining, tourism, and services) simultaneously. The forward linkages have been assisted from the backward linkages, when there are investments in infrastructural projects namely roads, bridges, highways and pedestrian bridges through construction material, engineering and financial services, which decrease cost of transports, expansion of markets accessibility, supply chain improvement, and commercial activities facilitation respectively. In addition, the emergence of third party

insurance has made the complementary sectors where transportation development had induced their growth, and the expansion of transportation infrastructure has increased vehicles, freight operators, logistics firms and services from commercial transport.

In fact, the expansion had led to demand for compulsorily mandatory of third party insurance policy due to accidental loss, injuries and litigation liabilities, which these are subsequently reinforced the provisions of financial protection, mobilization of investment capital, credit market support, and resilient transport-related businesses improvement. Consequently, the integrated relationship between transportation infrastructure and third-party insurance in Northern Nigeria is however established as a complementary evidence instead of independent view. Likewise, increased in transportation infrastructure expansion involves transportation activities and risk exposure from accidental occurrence. Meanwhile, financial effects from the apparent risks are decrease because of the purchase of third party insurance, which this often improves continuity in business operation, entrepreneurship encouragement, and investment facilitation as well as productivity improvement across the components of economy that networks can generate widespread multiplier effects throughout agriculture, commerce, manufacturing, and services, and these complementary consequences add to increase in GDP and regional economic development inclusion.

2.4 Theoretical Framework

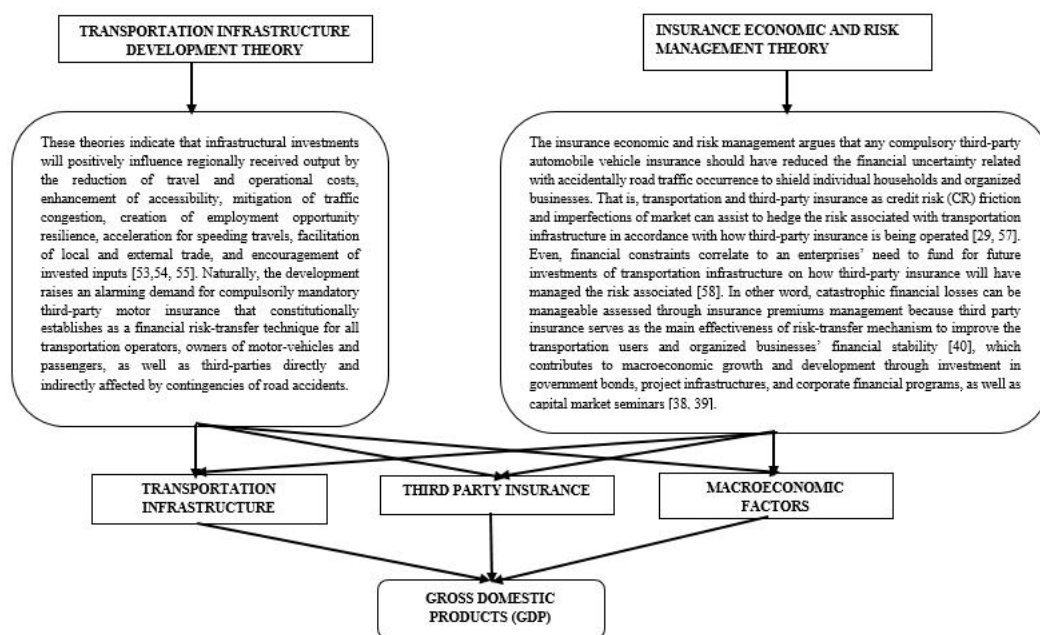


Figure 2. Theoretical framework studied. Source: Authors' Design, 2026.

2.5 Empirical Review

2.5.1 Socioeconomic Information, Transportation Infrastructure, and Third Party Insurance

Adopting the Hirschman's theory of unbalanced growth, Ebelechukwu et al. [6] assessed the consequences of Transportation Infrastructural Development on Nigerian economy. The results indicated that transportation infrastructural development directly and significantly revealed to influence the Nigerian rate of unemployment. Based on this, the recommendation suggested that government investment on transportation infrastructure should assist to intensify economic growth that will immediately build sustainable employment possibilities in Nigeria. This is also in line with the study in Ref. [13], which investigated the consequences of transportation infrastructural development and socio-economic well-being of residential settlements in Baro. The questionnaire survey was adopted as the primary data approach with 394-sample size, but 350 structured questionnaires were completed, adopting simple percentage and Chi-Squared analysis as the descriptive and inferential statistical techniques respectively. The results revealed that transportation infrastructural development is significantly and positively influence on socio-economic well-being, building to enhance the educational and healthcare accessibility and employment possibilities. To improve this, land (road and rail) network accessibility prioritization and constructive rehabilitation should be suggested in order to ease passengers' efficiency and movement of products.

In the same vein, Adebayo and Agum [59] examined the road transportation influence and the growth of Nigerian economy within a 38-year (1985-2022), adopting an ordinary least square estimation technique as a multivariate regression approach from the Central bank of Nigeria and the Nigerian Bureau of Statistics respectively. Empirically, the results revealed road transportation significantly influenced the growth of Nigerian economy during the reviewed period. Meanwhile, both the output of road transport industry and government expenditure from the estimated

coefficients revealed to be significantly statistical on road infrastructure at 5% significance level. Although, government expenditure level revealed negatively influenced the productivity aggregate on Nigerian economy through road infrastructure. Based on this, the recommendation suggested between other things being equal that the allocation of budget on road transport industry should be significantly increased.

Kaiser and Barstow [4] explored the road transport investment and growth of Nigerian economy, adopting ex-post facto research design as a ready-made data within time series of a 36-year (1980-2015). The findings, in addition, indicated a change in 1 percent in investment of road transport, which statistically revealed a positive change in the growth of economy with an 0.22% at significance level of 5%. The study on international transportation through aviation and marine has facilitated proportionally significant the volume and value with the globe by Isimoya and Akindipe [60], using the insurance digest and financial reports of Nigeria Insurers Association (NIA) to gather data of both gross premium-earned and gross claims incurred with a period. It observed that there is no substantive association between total values of gross premium earned and total values of gross claims incurred international insurance of marine and aviation policies.

Using the descriptive statistics to operate the analysis of socio-economic characteristics through the structured questionnaire, and correlation and regression as the inferential statistics, Adeyemo et al. [8] assessed the influence of third party motor vehicle insurance for regulatory compliance on risk management of road traffic liability. The results indicated that third party motor vehicle insurance for regulatory compliance serve as the determinant of the risk security for motorists' liability, which efficiently increases the gross premium Income of insurance firms and directly contributed to the growth of economy (GDP). Meanwhile, the research in addition, indicated the enforcement of motor insurance regulatory law for accidental road compensation, which affects third party motor vehicle insurance for regulatory compliance. The recommendation suggested that the Federal Government agencies should have to conceptualize a scheme that will assure motorists compliance within the third party motor vehicle insurance for regulatory compliance.

With the use of Generalized Methods of Moments (GMMs), Ogundipe et al. [61] investigated the influx effect between road infrastructure's role and foreign direct investment (FDI) in ECOWAS, which occurred that the FDI's responsiveness to physically infrastructural structure indicated on the economic growth's responsiveness to the deterioration of road infrastructural structure. In the same vein, Ojide et al. [62] investigated the earnings return of rural household on road infrastructural content, adopting a guide interview and structured questionnaire in order to have collected data from 400 respondents through households. The results indicated that Ogoni community suffered from lack of adequate road accessibility. Almost 56.60% households as the majority revealed to have a low access to road infrastructure. Nevertheless, the research asserted that the earning return from households is significantly positive to have an improvement on road infrastructure in Ogoni community. Meanwhile, there is 30.0% log-odds unit increase as a higher marginal effect in household income, which gives an increased in good road accessibility categories. To drastically decrease the rate of poverty, there is necessity from governmental agencies to cooperate with organizations and people-centered abilities towards the provisional accessibility to road within the community.

Skorobogatova and Kuzmina-Merlino [63] opined that the integral aspect of transportation system is transport infrastructural provision of most city and State. The objective of this study is the performance, measurement and relationship between transport infrastructure and economic growth as discussions from academic and non-academic perspectives in Latvia. The study reviews on the need for the methodology development to measure the transport infrastructure performance. Therefore, the study should have systematically applicable in order to have holistically assist all responsible populace making transportation as associative decisions.

Ajemunigbohun and Oreshile [64] carried out the investigation for which, the study was conducted in United States, adopting a cross-sectional survey design, and indicating a strongly correlated relationship between the attitudes of motorists' risk and the auto insurance requirement establishment through the Lagos Metropolitan Area as the scope of the study. The study commenced from early of December 2012 to continue during February 2014 through a structured questionnaire, and randomly stratified sampling was utilized to gather data from 270 people as the sample size. In order to test the normality of data collected from the respondents, Kolmogorov-Smirnov test was employed and linear regressions would be adopted if the data distributed was normal. The finding was highly associated but insignificantly relative between the constructions deduced. Therefore, the mind-set of drivers' risk within the risk incidence is necessary for auto insurance policy.

Abdul-Fatawu et al. [65] asserted the determinants of life insurance demand in the Northern region of Ghana using primary data through a structured questionnaire and adopting binary logistic regression model. The result showed the easy access to claims when due, perceptions about services of insurance firms and employment status were statistically significant as the determinants of the demand for life insurance policies in the Northern region of Ghana. Though, age and number of dependents were statistically insignificant, they were positively associated with the demand for life insurance. Also females, Christians as well as married persons were found to have more chance of taking life insurance. Therefore, the recommendation suggested that the access to claims should be made easier and convenient; customer services should be improved for improved better perceptions about life insurance companies; segmenting potential customers using the sector of employment could help life insurance firms to easily target potential customers in the sale of life policies; the Whole life and Term life policies should be redesigned with more attractive features.

Fadun et al. [66] postulated that the socio-economic determinants of life assurance purchase in Nigeria. The survey research approach, convenient sampling technique and linear regression analysis were employed through selected civil servants in the Enugu State Government ministry and validate the research hypothesis at a 0.05 significant level respectively. The findings statistically showed that education and occupation revealed 39% and 40.5% respectively affect the demand of life assurance products in Nigeria, which income level and premium (price) revealed 39.9% and 55.6% influence on the demand of life assurance products respectively. Generally, the integration of socio-economic factors of this study were significant influence the life assurance products demand in Nigeria. Therefore, the recommendation suggested that the regulatory bodies and stakeholders should consider the introduction of insurance education in schools, broadcasting station namely radio and televisions stations across the country. Life assurance providers should develop specialized products targeting individuals in high-risk occupations. Furthermore, occupation, income level, and product pricing should inform product design and sales strategies, as these factors significantly determine life assurance purchases.

Badru et al. [67] opined that risk avoidance helps individuals to cope with the tragedies of life. Insurance patronage in sub-Saharan Africa (with the exception of South Africa) is abysmally poor. Empirical studies on the impact of socio-cultural factors on insurance patronage are slim. Besides, meanings attached to modern insurance concepts such as 'accident' and 'disasters' are culturally constructed. This study, as an exploratory work, investigated some of the socio-cultural variables that shape insurance patronage among Nigerians using Lagos State as a focus. Such variables act as agents of socialization through which people receive the norms and values that shape and modify their attitudes and behavior. The research design was a cross-sectional survey, exploratory in nature, using structured questionnaires to collect primary data. Variables were created for both univariate and bivariate data and analyzed with the Statistical Package for Social Sciences (SPSS). Findings from the survey suggest that many users of insurance in Lagos understood the language of insurance policies, have positive values and norms, and that their religious persuasions do not impact negatively on insurance patronage. It is thus possible to motivate Lagos in particular and Nigerians in general to patronize insurance services. Other feasible measures to boost patronage were recommended for practitioners and policy-makers. This study is a platform for broader research in future.

2.5.2 Transportation Infrastructure and Third Party Insurance

Both these variables have been recognized increasingly as complementary factors that are adopted in effectively sustaining transport system.

Dawodu [68] argued the investigation between road infrastructure conditions and motor insurance claim patterns in Lagos State, Nigeria, anchoring Cramér's Risk Theory and examining specifically the consequence of road infrastructure deficiencies on the frequency, and severity, as well as the costs of motor insurance claims payment. The study indicated, adopting regression analysis, that poor road infrastructure namely lacks of adequate traffic signage, potholes, and poor drainage systems as well as unsafe intersections, enhances significantly the frequency and severity of motor insurance claims costs. The findings, in addition, indicated that the improvement of drainage systems are related to lower claim severity and reduced insurance costs. The study has to recommend the investment increment in road rehabilitation, drainage systems, lighting, and traffic calming measurement in order to decrease the rates of accidental injuries, costs reduction of insurance claims, improvement of underwriting efficiency, and promotion of safer for much more transportation sustainability in Nigeria.

Enyinda [69] evaluates the trending assessment of motor accident insurance claims in Nigeria, adopting ex-post facto research design through secondary data collection from officially published annual reports of four (4) selected insurance companies within Lagos-Nigeria through Nigeria Insurance Association (NIA). Descriptive analytical statistics was employed to analyze the collected data, which the results revealed that the performance of insurance companies were not favorable in accordance with claims settlements especially during the recapitalization period. Meanwhile, the customers were retained during the period if and only if genuine claims were settled by insurance companies, in which the policyholders could renew their insurance policies. The recommendations hereby suggested that the government should propose a new recapitalization regime in order to have standardized insurance sector so that much more capital base could use to handle genuine claims adequately.

Adepoju [70] investigates the vital issues surrounding road transportation infrastructure in sustaining the present road users in South-Western Nigeria, using Principal Component Analysis as indicator for the government inability of to build and maintain road infrastructures. The challenges and effects were explained using descriptive statistics analysis for adequate road on national development and economic growth. The results indicated several barriers responsible for the government inability to build and maintain roads infrastructure, including erosion, lack of adequate skilled labor, capital equipment, financing and funding, user's maintenance cultures. Meanwhile, the consequences for poor roads infrastructure are 27%, 21%, 17%, 14%, 11% and 10% revealed for road crashes, high vehicle maintenance cost, capital flight, passengers' discomfort, high transportation cost and drivers' fatigue respectively. The study recommended that the government should monitor and supervise any road constructions by the private companies. In addition, there should be separation power between the states and local government authorities in terms of road construction projects. Likewise, there should be procedural standardization in accordance with quality, usage, penalty and rehabilitation of road infrastructural construction in order to attain development and sustainability.

Rodrigue [32] opined to explain the efficiency of transportation systemic operation in increasing the mobility of passenger and freight, which improves simultaneously the association of operational risk exposures with road as a means of transportation. That is, these operational risks build greater responsiveness of demand for mechanisms of risk management strategies especially compulsory third party vehicle insurance. Banister and Berechman [48] asserted that the infrastructure of transportation investments has improved accessibility, transportation costs reduction, and commercial activities improvement, which this increases effectively the demand for insurance because much more operations of commercial vehicular services are engaged within the improvement of transport networking services.

2.5.3 Macroeconomic Factors and Gross Domestic Product

Dagare [71] argued that the investigation of government spending role in affecting economic development, adopting data from various countries and economic sectors in order to examine their association between public expenditure and economic growth. The government's expenses have revenue expenditure and capital expenditure. The study resulted that the public funds allocation strategy in infrastructural projects, educational and health sectors enhance adequately and significantly on economic growth, despite the spending inefficiency that might have hampered prospects in economic development. Based on this study, the associated complexity between government expenditure and national economic growth and development has explored in contributing on how public spending affected economic growth and development from different channeled angles such as infrastructural development, creation of job opportunities and enhanced human capital development.

Ahmad et al. [72] investigated the fiscal policy determinants (government revenue, expenditure, and overall economic stability) that are vital for economic development from 2000 to 2023 through annual data for analysis, adopting regression statistical analysis for the estimation method. The exploration of this study is objectively aimed to bring the association between government revenue, expenditure, and overall economic stability and economic development within the exchange and inflation rates as intervening roles. The findings reveal that tax revenue, Foreign aid and trade surplus increasingly affect the economic development because it is significantly positive relationships. Meanwhile, government expenditure reveals a significantly negative association. Moreover, the exchange rate and inflation rate play a moderating role in enhancing the relationship between fiscal policy determinants and economic development with significant intention. Therefore, the study suggests the significant advocacy for policy implications to investors, government, and legislators.

Owuna et al. [73] established the insurance sector's Impact on economic growth in Nigeria within 1990 and 2023, utilizing and extracting data from secondary sources through the central bank of Nigeria annual statistics bulletin, and world development indicator (WDI) database in 2023. The unit-root test was undertaken through employment of augmented Dickey-Fuller method in order to investigate maybe there are stationary or not. The finding shows that the variables are all stationary. The study adopted co-integration test, which the results show that there is evidence of long run association among variables, where the vector autoregression (VAR) model is for the estimation. The findings showed that life insurance premium (LIP) has positive and statistically significant impact on gross domestic product in Nigeria. Similarly, the results showed that non-life insurance premium (NIP) and insurance penetration rate (IPR), insurance claim settlement (ICS) have positive and statistically insignificant impact on gross domestic product in Nigeria. The recommendations suggest that the government should encourage and emphasize long-term planning since life insurance encourages individuals and businesses to think long-term plan. In order to have a sustainable economic growth through fostering a financial culture responsible for economic stability. In addition, enhancement of financial literacy programs that can assist in educating the population concerning the significance and benefits of life insurance policy.

Fadun [74] investigated the impact of insurance claims settlement on economic growth in Nigeria, emphasizing the role of prompt claims payment in enhancing public confidence in the insurance industry and supporting economic activities. The study employed an ex post facto research design using annual time-series data spanning 1992 to 2019. Gross Domestic Product (GDP) served as the dependent variable, while insurance claims settled by Nigerian insurance companies constituted the independent variable. The long-run cointegration analysis revealed that insurance claims settlement exerted a negative but statistically insignificant effect on GDP. Specifically, the estimated coefficient indicated that a 1% increase in insurance claims settled was associated with an approximately 1.22% decline in GDP. The findings suggest that insurance claims settlement did not significantly contribute to economic growth during the study period, implying that the relationship between insurance claims and economic performance may depend on country-specific institutional, economic, and insurance market conditions. The study concluded that improvements in insurance sector efficiency, regulatory effectiveness, and market development are necessary for insurance claims settlement to make a more meaningful contribution to Nigeria's economic growth.

Fadun and Silwimba [75] investigated whether does insurance promote economic growth? Evidence from Nigeria. The study analyses the contribution of insurance to economic growth in Nigeria. The research utilized an ex-post facto design, using 28- year time series data (1992-2019). The study's dependent and independent variables were gross domestic product (GDP) and insurance (life and non-life) premiums. The long-run co-integration result indicated that non-life premium (NLP) positively impacted GDP. The coefficient shows that a percentage increment in NLP results in a 5.63 increase in GDP. The long-run co-integration results suggested that life premium (LP) positively impact GDP.

The co-efficient also shows that a percentage increment in LP results in a 4.25 increase in GDP. The results revealed a significant positive contribution of insurance to economic growth. It indicates a significant positive impact of insurance (life and non-life) premiums on economic growth in Nigeria. The results suggest that insurance contributes positively to a nation's economic activities and promotes economic growth. The government should formulate and implement economic policies to stimulate insurance activities, enforce statutory insurance and sound corporate governance.

Oloyede et al. [76] examined the impact of insurance on economic growth in Nigeria from 1986 to 2020. Using short run ordinary least square (OLS) model. The present study utilizes Real Gross Domestic Product (RGDP) as a proxy for economic growth, serving as the dependent variable while Total Insurance Premium (TPR), Total Insurance Claim (TIC), Total Insurance Investment (INV) and Inflation Rate were used as the explanatory variables. Short run of OLS result revealed that value of total insurance claims, total insurance investment and inflation rate had an insignificant impact on economic growth while total insurance premium has a significant relationship on economic growth. However, in the short run, insurance firm's indicator had a positive impact on economic growth in the short run and concluded that insurance firms' indices have a positive impact on economic growth in the short run. Therefore, recommended that insurance policies be made mandatory for individuals and business organizations to encourage and protect investors as well as ensure sustained economic growth; that the regulatory authorities should put in place policies to enforce transparent and efficient management of funds by insurers; that investors should diversify their portfolio of investments to boost returns and their ability in claims payment.

2.6 Research Gaps

Based on the above theoretical and empirical studies reviewed, the research gaps observe in relation to the relationship between social-economic information, transportation infrastructure, and third party insurance are critical explored from all empirical studies, in which transportation infrastructural networks namely road, rail, marine and aviation showed a consistently positive and significant effect on the growth of the economy as the main explanatory variable positively driving national income as gross domestic products (GDP). In addition, there is also reduction of unemployment, improvement of household income, healthcare and education accessibility and socio-economic well-being as whole, which all these serve as intervening variables in the regression.

More so, government spending on road infrastructure shows sometimes indirectly effect because of misallocation of funds, corruption and embezzlement as well as inadequate project execution, which this serves as the controlling variables on the model. Meanwhile, institutional regulation and policy indicate as factors that mediate the effectiveness of transportation infrastructures and third party insurance in terms of motor, marine and aviation insurance compliance and enforcement as well as its systemic risk management, which these may significantly influence the efficiency of transport sector and productivity as well as business trade of the economy as whole.

Furthermore, poorly infrastructural projects usually reduce the inflow of foreign direct investment (FDI) and government taxes as well as adequately strong transportation infrastructures prudently attract competitiveness from the other African neighboring countries through ECOWAS funding, which these serve as inflows from external capital. Meanwhile, inequality accessibility and poverty dynamics from rural and underserved settlements may result to low access to roads for their business, which may lead to lower levels of income generation as spatial variables.

3. Methodology

The cross-sectional explanatory research design is employed to incorporate both primary and secondary data sources, in which the cross-sectional design is appropriately adopted in order to enable the data to have collected from different respondents and locations at an individual point in time, whereby the facilitation of the examination association among socioeconomic information, transportation infrastructure, and third party insurance within Lafia and Dutse metropolises [77]. The explanatory components are employed as a result of describing the variables and determining the magnitude and direction of the effects and relationships on GDP [78]. In addition to this, the study uses to combine micro and macro levels of analysis based on household and vehicle-owner survey, and national indicators respectively, providing behavioral evidence affecting transportation infrastructure and third party insurance on one hand and macroeconomic components of economic growth on the other hand.

The primary data are collected from Lafia and Dutse metropolis in Nasarawa State and Jigawa State respectively. The cities are purposively selected as administrative capitals because of their expansion in transportation systems, and compulsorily mandatory third party vehicle insurance policy, which their socioeconomic and transport information are enhanced for the interactive examination between transportation infrastructure and insurance patronage. Meanwhile, the secondary data are elicited from CBN Statistical Bulletin and National Insurance Commission (NAICOM).

The multistage sampling approach conducted in this study indicates notable findings because Lafia and Dutse are purposively embraced as the strategic transportation and commercial importance. Subsequently, stratified random sampling is adopted from the respondents in order to have adequate representation for robust-fully and credibly affecting the methodological limitations. Meanwhile, the primary data collected is used to measure the objectives one and two as stated above. The content validity is employed through Cronbach's Alpha, which is greater than or equal to 0.70 (Table 1).

Furthermore, the targeted population targeted consisted all actively economical individual households, formal businesses and commercially enterprise transport operators in Lafia and Dutse Local Government Areas (LGAs). Based on the records from National Population Commission and Vehicle Inspection Office (VIO), the estimated population would be 500 units in 2025, where the sample size is determined through the justification of Taro Yamane formula at 5% margin of error as 222 respondents from the population. Moreover, limitation arises where 38.74% indicates as the attrition rate out of 222 structured questionnaires from which the substantial reduction in usable respondents with only 136 questionnaires collected for analysis, which represents 61.26% respondent rate (Table 1).

Logically, 200 structured questionnaires were administered for even distribution and convenience as per the cities. This represents 40% of the population, but 136 questionnaires were received and found usable giving a respondent rate of 68% and the attrition rate of 32% as the non-response. Nevertheless, the actual sample of 136 indicates 27.20% of the total population. Additionally, the final sample size of 136 constitutes only 27.2% of the total population. raising significant concerns about representative. Meanwhile, the sample size is derived using Taro Yamane formula, which this is computed as follows below [62]:

$$S = \frac{N}{1 + N(e^2)} \quad (1)$$

S = required sample size.

N = the population size.

e = the degree of accuracy expressed as a proportion (.05).

$$S = \frac{500}{1 + 500(0.05^2)}$$

$S = 222.222$ approximately to 200 as the sample size.

Table 1. Measurement of population and sample size.

Measurement	Value	Formula	Interpretation
Estimated Population (N)	500	Sampling Frame	Total eligible units
Computed Sample (n)	222	Taro Yamane, $e = 0.05$	44.4% of N
Administered Questionnaires	200	Researcher decision	40.0% of N
Retrieved Respondents	136	Count	68.0% response rate
Attrition Rate	32%	$(200-136)/200 \times 100$	Non-response
Sampling Fraction	27.2%	$136/500 \times 100$	% of N actually analyzed data

Source: Authors' Design, 2026.

In addition, the descriptive statistics (mean and standard deviation), validity and reliability test through Cronbach analysis, normality test (Shapiro-Wilk, if $p > 0.05$ use parametric test, but if < 0.05 use non-parametric test, Pearson or Spearman's rho to test bivariate relationship, Multiple Linear Regression or Kruskal-Wallis.

Table 2. Descriptive statistics for normality test of the control variables.

$n = 136$		Statistic	Std. Error
Age Bracket	Skewness	0.208	0.208
	Kurtosis	-0.463	0.413
Gender Status	Skewness	2.516	0.208
	Kurtosis	4.394	0.413
Occupation Engaged	Skewness	2.015	0.208
	Kurtosis	2.092	0.413
Marital Status	Skewness	-0.651	0.208
	Kurtosis	-0.530	0.413
Highest Qualification	Skewness	0.268	0.208
	Kurtosis	-0.676	0.413
How long have you been living in Northern Nigeria?	Skewness	-1.509	0.208
	Kurtosis	1.012	0.413
Aggregate Transportation Infrastructure	Skewness	0.077	0.208
	Kurtosis	-0.026	0.413
Aggregate Third-party Insurance	Skewness	0.586	0.208
	Kurtosis	-1.055	0.413

Source: Researchers' Computation, 2026.

The interpretation of Table 2, the Normality test of the distribution examines if the socio-economic information is normally distributed using skewness and kurtosis, the rule of thumb states that the data is approximately normal if skewness is between -2 and +2, and kurtosis is between -7 and +7. For stricter standards, skewness between -1 and +1 and kurtosis between -2 and +2 is an ideal, where Z-score is equal to Statistics divided by standard error i.e. $|Z| < 1.96$ means normal at $p > 0.05$.

$$Z = \frac{\text{Statistics}}{\text{Standard Error}} \quad (2)$$

Table 3. Reliability statistics of transportation infrastructure and third-party insurance.

Cronbach's Alpha	N of Items
0.648	7

Source: Authors' Computation, 2026.

From Table 3, the reliability of the 7-item scale is assessed using Cronbach's Alpha. The resulting coefficient of 0.648 indicates acceptable internal consistency for exploratory research, though 0.70 is the conventional threshold. This suggests that the items are moderately correlated and adequately measure the intended construct.

Table 4. Computation of Z-Skewness and Z-Kurtosis.

Variable	Skewness	Z-Skewness	Kurtosis	Z-Kurtosis	Normality	Decision
Age Bracket	0.208	1.000	-0.463	-1.121	Normal	Positive Skewed, Mesokurtic
Gender Status	2.516	12.096	4.394	10.640	Not normal	Severe positive Skewed, Leptokurtic
Occupation Engaged	2.015	9.688	2.092	5.070	Not normal	Positive Skewed, Leptokurtic
Marital Status	-0.651	-3.130	-0.530	-1.280	Not normal	Negative Skewed, Kurtosis normal
Highest Qualification	0.268	1.288	-0.676	-1.640	Normal	Positive Skewed, Mesokurtic
How long have you been living in Northern Nigeria?	-1.509	-7.255	1.012	2.450	Not normal	Negative Skewed, Leptokurtic
Aggregate Transportation Infrastructure	0.077	0.370	-0.029	-0.070	Normal	Positive Skewed, Mesokurtic
Aggregate Third-party Insurance	0.586	2.820	-1.055	-2.554	Not normal	Positive Skewed, Platykurtic

Source: Researchers' Computation, 2026.

Table 4 shows the interpretation of the above results indicate that almost all the variables are positively skewed except marital status and how long living in the Northern-Nigeria revealed otherwise. Skewness values range from -1.509 to 2.516. The positive sign means the tail is longer on the left. Most respondents scored high on these scales. The distributions pile up toward 4 and 5 on the 5-point scale. The Z-scores for skewness all exceed $|1.96|$, so skewness is statistically significant. The data are not symmetric. Kurtosis is acceptable, ranging from -0.439 to 0.748. All are within ± 2 and Z-scores are < 1.96 . This means that the peak and tail heaviness are not extreme. This pattern creates left skew - few low scores drag the tail left while most scores cluster high.

Data are not normally distributed due to significant positive skewness on almost all the variables except marital status and period lived in the Northern. The Kurtosis is fine aside gender status and occupation engaged that $Z > 1.96$ with 10.640 and 5.070 respectively, but skewness violates normality assumptions except age bracket, highest qualification and transport infrastructure. The implications for this analysis is to employ the use of non-parametric tests since normality is violated i.e. Spearman's rho test is appropriate for objective 2. Although, multiple regression can also be considered as a parametric test for one objective one.

Table 5. Normality test for socio-economic, transportation infrastructure and third-party insurance.

	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Age Bracket	0.220	136	0.000	0.899	136	0.000
Gender Status	0.527	136	0.000	0.362	136	0.000
Occupation Engaged	0.513	136	0.000	0.422	136	0.000
Marital Status	0.432	136	0.000	0.624	136	0.000
Highest Qualification	0.236	136	0.000	0.870	136	0.000
How long have you been living in Northern Nigeria?	0.347	136	0.000	0.674	136	0.000
Aggregate Transportation Infrastructure	0.182	136	0.000	0.951	136	0.000
Aggregate Third-party Insurance	0.190	136	0.000	0.863	136	0.000

Source: Researchers' Computation, 2026.

From Table 5, the normality was assessed using skewness or kurtosis, Z-scores and Shapiro-Willis tests. The Shapiro-Willis tests were significantly revealed for all variables i.e. $p < 0.001$, which these suggest non-normality. Meanwhile, $|Z| < 1.96$ from age bracket, highest qualification, and aggregate transportation infrastructure were approximately normal, but aggregate third-party insurance violated the assumption of normality test in Z-Skew and Shapiro-Willis with 2.82 and (0.863, $p < 0.001$) respectively. In order to support the Central Limit Theorem and association, the adoption of parametric tests and non-parametric tests for inferential analysis for objective one and objective two respectively.

Based on the primary data collected for this study, the data were analyzed using both descriptive and inferential statistics methods. Normality of the variables was assessed using Z-skewness and Z-kurtosis statistics. To attain the objectives of the study, the following inferential techniques were adopted:

Multiple regression analysis was adopted to examine the effect of socio-economic characteristics on transportation infrastructure and third-party insurance. This method is appropriate as it allows for the estimation of the combined effects of the independent variables on a dependent variable [37].

$$TRI = f(AGE, GES, OCE, MAR, HQN, HLL) \quad (3)$$

$$TRI = \beta_0 + \beta_1 AGE + \beta_2 GES + \beta_3 OCE + \beta_4 MAR + \beta_5 HQN + \beta_6 HLL + \epsilon \quad (4)$$

$$TPI = f(AGE, GES, OCE, MAR, HQN, HLL) \quad (5)$$

$$TPI = \beta_0 + \beta_1 AGE + \beta_2 GES + \beta_3 OCE + \beta_4 MAR + \beta_5 HQN + \beta_6 HLL + \epsilon \quad (6)$$

Where:

TRI = Transportation Infrastructure

TPI = Third-Party Insurance

AGE = Age Status

GES = Gender Status

OCE = Occupation Engaged

MAR = Marital Status

HQN = Highest Qualification

HLL = How long living in the Northern-Nigeria

$\beta_0 - \beta_6$ = Coefficient of the independent Variables.

In addition, Spearman rank correlation was adopted to determine the relationship between transportation infrastructure and third-party insurance because of the non-normal distribution of the insurance variable (Table 6)..

$$r_s = 1 - \frac{6 \sum d^2}{n(n^2 - 1)} \quad (7)$$

Where:

r_s = Spearman rank correlation coefficient ;

d = difference between the ranks of each pair of transportation infrastructure and third-party insurance; i.e.
 $d = R_{tri} - R_{tpi}$

$$\sum d^2 = \text{sum of square differences in ranks}$$

n = number of observations

More so, the secondary data collected is to measure objective three through multiple regression analysis employed, which examine the effect of macroeconomic variables on gross domestic product (GDP) in Nigeria to test multicollinearity and autocorrelation for the validity of the regression models. However, the research gaps deduce above lead to a conceptual model that necessitates the study adequacy is stated below [37] (Table 6):

$$GDP = f(TRS, GOE, INF, EDA, TRB, GOT) \quad (8)$$

$$GDP = \beta_0 + \beta_1 TRS_{it} + \beta_2 GOE_{it} + \beta_3 INF_{it} + \beta_4 EDA_{it} + \beta_5 TRB_{it} + \beta_6 GOT_{it} + \epsilon \quad (9)$$

Where:

GDP = Gross Domestic Products

TRS = Transport Services

GOE = Government Expenditure

INF = Insurance Factor

EDA = Education Accessibility

TRB = Trading Business

GOT = Government Taxes

$\beta_0 - \beta_6$ = Coefficient of the independent Variables. All statistics analyses are carried out using the Statistical Package for Social Sciences (SPSS), and results were interpreted at a 5% level of significance.

Table 6. All macroeconomic variables and economic growth variable.

Operating Year	Transport services Billion	Government Expenditure Billion	Insurance Value Billion	Education Accessibility Billion	Trading Business Billion	Government Taxes Billion	GDP Billion
2000	11.84	701.05	118.51	350.17	2675.45	260.88	25430.42
2001	13.03	1018.00	123.25	355.83	2742.34	276.69	26035.32
2002	15.18	1018.18	159.51	383.83	2920.11	319.08	31064.27
2003	15.18	1225.99	128.76	410.83	3088.31	341.83	33346.62
2004	16.08	1462.05	142.73	455.40	4220.22	373.64	36431.37
2005	17.03	1840.77	158.21	503.44	4790.51	398.22	38777.01
2006	18.07	1942.59	176.10	557.67	5521.46	423.00	41126.68
2007	19.18	2348.55	196.05	617.78	6360.81	451.51	43837.39
2008	20.36	3078.25	217.59	684.31	7252.60	482.75	46802.76
2009	21.48	3280.77	238.47	752.79	8085.44	521.90	50564.26
2010	22.65	3993.31	260.07	826.67	8992.65	857.09	55469.35
2011	26.96	4233.06	265.13	1087.67	9640.90	669.31	58180.35
2012	33.39	4199.86	226.20	1105.90	9853.68	740.16	60670.05
2013	39.14	4797.49	241.52	1278.41	10507.90	724.12	63942.85
2014	44.69	4210.06	258.89	1391.95	11125.80	824.67	67977.46
2015	47.11	4650.30	272.07	1498.71	11697.59	756.76	69780.69
2016	46.58	4813.72	278.76	1518.93	11669.06	721.19	68652.43
2017	46.68	6022.29	270.68	1507.98	11546.45	714.71	69205.69
2018	47.60	7357.29	287.24	1507.56	11473.79	736.41	70536.35
2019	48.87	9282.77	297.55	1519.66	11430.55	706.27	72094.09
2020	46.55	9804.28	252.02	1313.39	10459.70	786.17	70800.54
2021	48.45	11667.62	267.74	1303.55	11360.90	989.10	73382.77
2022	51.15	14136.13	290.98	1321.11	11943.70	1129.48	75768.95
2023	53.27	18773.77	305.02	1338.40	12141.37	1251.16	77936.10

Source: Central Bank of Nigeria Statistical Bulletin, 2025.

4. Results and Discussion

4.1 Descriptive Statistical Analysis

Table 7. Descriptive statistics for socio-economic information.

	N	Minimum	Maximum	Mean	Standard Deviation
Age Distribution	136	1	5	3.09	0.977
Gender Status	136	1	2	1.11	0.314
Occupation	136	1	2	1.15	0.355
Marital Status	136	1	3	1.74	0.475
Highest Qualification	136	1	4	2.24	0.896
How long have you been living in Northern Nigeria	136	1	6	5.09	1.443
Valid N (Listwise)	136	N/A	N/A	N/A	N/A

Source: Authors' Computation, 2026.

As shown in Table 7, this presents descriptive statistics for various socio-economic information variables. 136 respondents represent the sample size of the study from the administered questionnaire. The minimum and maximum show the range of values for each variable. Age and How long have you been living in Northern Nigeria? are ranged from 1 to 5 and 1 to 6 respectively. While Gender status, Occupation, Marital status, and Highest qualification are ranged from 1 to 2, 1 to 2, 1 to 3 and 1 to 4 bracket respectively, and 1 to 6 as those who live 1-5 years, and 26 and above years respectively. While Gender status, Occupation, Marital status, and Highest qualification are ranged from 1 to 2, 1 to 2, 1 to 3 and 1 to 4 respectively, which means that female respondents are higher than the male, informal occupation respondents are higher than the formal ones, divorced respondents are having higher response compare to single ones, and other respondents who O'level certificate are having more response compare to PhD level respectively.

The mean and standard deviation reveal to be 3.09 and 0.977; 1.11 and 0.314; 1.15 and 0.355; 1.74 and 0.475; 2.24 and 0.896; and 5.09 and 1.443 for age distribution, gender status, occupation, marital status, highest qualification, and those number of period living in Northern Nigeria respectively. The above mean results indicate that those who are with the bracket age of 36-45 years are proactive to transportation infrastructure and third party insurance. In addition, the male gender is more reactive to transportation infrastructure and third party insurance. Likewise, the formally engaged occupation is also more aware of transportation infrastructure and third party insurance. More so, single as one of the marital status is more informed compare to others in term of transportation infrastructure and third party insurance. Those who are holding Master of Science certificate are more aware compare to other holders in respect to transportation infrastructure and third party insurance. Nevertheless, those who are living in the Northern Nigeria with 21-25 are having response on transportation infrastructure and third party insurance in Northern Nigeria respectively.

Table 8. Descriptive statistics for transportation infrastructure.

	N	Minimum	Maximum	Mean	Standard Deviation
How would you rate the condition of roads in Northern Nigeria?	136	1	4	2.79	0.790
Which mode of transportation do you use most frequently?	136	1	3	1.69	0.590
Have you experienced any accidents or near misses on Northern Nigerian roads?	136	1	2	1.33	0.472
How important is transportation infrastructure to you?	136	1	5	4.64	0.832
What improvements would you like to see in Northern Nigeria's transportation infrastructure?	136	1	5	2.10	1.188
Valid N (Listwise)	136	N/A	N/A	N/A	N/A

Source: Authors' Computation, 2026.

As shown in Table 8, this represents the road condition rating reveals that the mean score of 2.79 out of 4 in addition with 0.790 as a standard deviation, which suggests the respondents overall rated the condition for roads in Northern Nigeria as mediocre. This aligns with reports that approximately 40% of Northern Nigerian roads are in poor condition, limiting accessibility and driving up transport costs. The mode of transportation reveals a mean score of 1.69 out 3 in addition with a standard deviation of 0.590. Most respondents frequently use one particular mode of transportation, likely personal vehicles or public transport. The accidents or near Misses reveals the mean score of 1.33 out of 2 in addition with a standard deviation of 0.472 indicates that most respondents reported not experiencing accidents or near misses on Northern Nigeria.

The importance of transportation infrastructure reveals the high mean score of 4.64 out of 5 in addition with a standard deviation of 0.832 shows that respondents consider transportation infrastructure crucial, which is consistent with the region's need for improved infrastructure to support economic growth. The desired improvements reveal the mean score of 2.10 out of 5 for desired improvements, coupled with a standard deviation of 1.188, suggests diverse opinions on what improvements are needed.

Table 9. Descriptive statistics for third party insurance.

	N	Minimum	Maximum	Mean	Standard Deviation
Are you familiar with third-party insurance?	136	1	2	1.20	0.400
Do you have third-party insurance for your vehicle?	136	1	2	1.41	0.494
How often do you renew your third-party insurance?	136	1	3	1.74	0.945
What motivates you to purchase third-party insurance?	136	1	4	2.07	1.248
Have you ever made a claim on your third party insurance?	136	1	2	1.950	0.222
Valid N (Listwise)	136	N/A	N/A	N/A	N/A

Source: Authors' Computation, 2026.

As shown in Table 9, the familiarity with Third-Party Insurance indicates the mean score of 1.20 out of 2 suggests that most respondents are familiar with third-party insurance, with 0.400 as a low standard deviation indicating a high level of agreement. The ownership of Third-Party Insurance indicates with a mean score of 1.41 out of 2, it appears that many respondents have third-party insurance for their vehicles, although 0.494 as the standard deviation indicates some variation in responses. The renewal frequency indicates the mean score of 1.74 out of 3 implies that respondents renew their third-party insurance fair regularly, but 0.945 as the standard deviation suggests a range of renewal frequencies.

The motivation for purchase reveals the mean score of 2.07 out of 4 indicates that respondents are motivated to purchase third-party insurance for various reasons, with 1.248 as a standard deviation suggesting diverse motivations. The claims experience indicates the mean score of 1.95 out of 2 implies that most respondents have not made a claim on their third-party insurance, with 0.222 as a low standard deviation indicating a high level of agreement.

In Nigeria, third-party insurance is a mandatory requirement for vehicle owners, covering damages or injuries caused to others in an accident. The average cost is around ₦15,000 per year for private vehicles, ₦20,000 for commercial vehicles, and ₦100,000 for trucks/trailers. Some top insurance providers for third-party plans.

Table 10. Descriptive statistics of economic growth and macroeconomic factors.

Variables	N	Minimum	Maximum	Mean	Std. Deviation
Gross Domestic Products	24	25430.42	77936.10	55325.5738	17119.26920
Transport Services	24	11.84	53.27	32.1050	15.07447
Government Expenditure	24	701.05	18773.77	5244.0896	4555.27312
Insurance Factors	24	118.51	305.02	226.3771	60.36120
Education Access	24	350.17	1519.66	982.9975	446.94787
Trading Business	24	2675.45	12141.37	8395.8871	3444.69991
Government Taxes	24	260.88	1251.16	644.0042	264.81898
Valid N (listwise)	24	N/A	N/A	N/A	N/A

Source: Authors' Computation, 2026.

As shown in the Table 10, the descriptive statistics for the study shows variables where Gross Domestic Product averaged of ₦55,325.57 billion with Standard Deviation of 17,119.27. This indicates a moderate variation across the observations. In addition, Transport Services had a mean index of 32.11 with Standard Deviation of 15.07. Also, Government Expenditure exhibits the highest variability of coefficient variable of 86.9% with values ranging from ₦701.05 billion to ₦18,773.77 billion, which suggests for substantial heterogeneity. Insurance Factors shows the least dispersion to reveal coefficient variable of 26.7%. Given the small sample size of 24, large scale differences and logarithmic transformations are to be applied to monetary variables in order to meet regression assumptions.

4.2 Regression Statistical Analysis

Table 11. Model summary for socio-economic information on transportation infrastructure.

Model	R	R Square	Adjusted R Square	Std Error of the Estimate
1	0.257 ^a	0.066	0.023	0.31357643

Source: Authors' Computation, 2026.

As shown in Table 11, this presents a summary of a regression model examining the relationship between socio-economic information and transportation infrastructure. The multiple correlation coefficient (R) is 0.257, indicating a moderate positive relationship between socio-economic information and transportation infrastructure. The coefficient of determination (R²) is 0.066, indicating that approximately 6.6% of the variation in transportation infrastructure can be explained by socio-economic information. The adjusted R² is 0.023, which is a more conservative estimate of the model's explanatory power. This suggests that the model's explanatory power is relatively low. The Standard Error of the Estimate (SEE) is 0.31357643, which represents the average distance between the observed values and the predicted values.

Table 12. ANOVA^a for socio-economic information on transportation infrastructure.

	Model	Sum of Squares	Df	Mean Square	F	Significance
1	Regression	0.897	6	0.149	1.520	0.177 ^b
	Residual	12.685	129	0.098	N/A	N/A
	Total	13.581	135	N/A	N/A	N/A

Source: Authors' Computation, 2026.

As shown in Table 12, this presents an analysis of variance (ANOVA) for a regression model examining the relationship between socio-demographic variables and transportation infrastructure. The F-statistic is 1.520, which is used to determine the overall significance of the model. Despite, the p-value is 0.177, which is greater than the typical significance level of 0.05. This indicates that the model is not statistically significant. The sum of squares for the regression model is 0.897, while the residual sum of squares is 12.685. This suggests that the model explains a relatively small portion of the variation in transportation infrastructure.

Table 13. Summary of the coefficient^a for socio-economic information on transportation infrastructure.

	Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	2.943	0.227		12.957	0.000		
	Age Bracket	-0.004	0.033	-0.013	-0.123	0.903	0.696	1.437
	Gender Status	-0.020	0.089	-0.020	-0.222	0.824	0.926	1.079
	Occupation Engaged	-0.041	0.079	-0.046	-0.514	0.608	0.920	1.087
	Marital Status	-0.172	0.068	-0.258	-2.526	0.013	0.695	1.440
	Highest Qualification	-0.019	0.031	-0.054	-0.608	0.544	0.922	1.084
	How long have you been living in Northern Nigeria?	-0.002	0.019	-0.008	-0.087	0.931	0.948	1.054

a. Dependent Variable: Aggregate Transportation Infrastructure

Source: Authors' Computation, 2026.

As shown in Table 13, this presents the coefficients of a regression model examining the relationship between socio-demographic variables and transportation infrastructure. The coefficient for marital status is statistically negative and significant effect on transportation infrastructure with $B = -0.172$; $\beta = -0.258$ and $t = -2.526$; $p = 0.013$ respectively. The coefficient for age Bracket is statistically negative and insignificant effect on transportation infrastructure with $B = -0.004$; $\beta = -0.013$ and $t = -0.123$; $p = 0.903$ respectively. The coefficient for Gender status is statistically negative and insignificant effect on transportation infrastructure with $B = -0.020$; $\beta = -0.020$ and $t = -0.222$; $p = 0.0824$ respectively. The coefficient for Occupation Engaged is statistically negative and significant effect on transportation infrastructure with $B = -0.041$; $\beta = -0.046$ and $t = -0.514$; $p = 0.608$ respectively. The coefficient for Highest Qualification is statistically negative and insignificant effect on transportation infrastructure with $B = -0.019$; $\beta = -0.054$ and $t = -0.608$; $p = 0.544$ respectively. The coefficient for length of residence I Northern Nigeria is statistically small negative and insignificant effect on transportation infrastructure with $B = -0.002$; $\beta = -0.008$ and $t = -0.087$; $p = 0.931$ respectively. However, only the marital status is revealed changes in association with a significant decrease in the transportation infrastructure finding as measured.

More so, the values of tolerance and Variance Inflation Factor (VIF) among the independent variables reveal the presence of no multicollinearity. That is, age bracket, gender status, occupation engaged, marital status, highest qualification and length of residence reveal no multicollinearity as indicated from the table. Based on this, the diagnostics of multicollinearity reveal that there is no evidence of multicollinearity among the socioeconomic characteristics as indicated in the regression equation, which means the variables of the independent components are not highly related within each other, and there is reliable and stable estimation that interpretation of model is satisfied the assumption of regression in respect with multicollinearity.

Table 14. Model summary for socio-economic information on third-party insurance.

Model	R	R Square	Adjusted R Square	Std Error of the Estimate
1	0.485 ^a	0.236	0.200	0.44280592

Source: Authors' Computation, 2026.

As shown in Table 14, this presents a summary of a regression model examining the relationship between socio-economic information and third-party insurance. The multiple correlation coefficient (R) is 0.485, indicating a moderate positive relationship between socio-economic information and third-party insurance. The coefficient of determination (R^2) is 0.236, indicating that approximately 23.6% of the variation in third-party insurance can be explained by socio-

economic information. The adjusted R^2 is 0.200, which is a more conservative estimate of the model's explanatory power. The Standard Error of the Estimate (SEE) is 0.44280592, which represents the average distance between the observed values and the predicted values.

Table 15. ANOVA^a for socio-economic information on third-party insurance.

	Model	Sum of Squares	Df	Mean Square	F	Significance
1	Regression	7.800	6	1.300	6.630	0.000 ^b
	Residual	25.294	129	0.196	N/A	N/A
	Total	33.094	135	N/A	N/A	N/A

Source: Authors' Computation, 2026.

As shown in Table 15, this presents an analysis of variance (ANOVA) for a regression model examining the relationship between socio-demographic variables and third-party insurance. The F-statistic is 6.630, which is used to determine the overall significance of the model. The p-value is 0.000, which is less than the typical significance level of 0.05. This indicates that the model is statistically significant. The sum of squares for the regression model is 7.800, while the residual sum of squares is 25.294.

Table 16. Summary of the coefficients^a for socio-economic information on third-party insurance.

	Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	1.764	0.321		5.499	0.000		
	Age Bracket	-0.186	0.047	-0.366	-3.970	0.000	0.696	1.437
	Gender Status	0.273	0.126	0.173	2.166	0.032	0.926	1.079
	Occupation Engaged	0.112	0.112	0.080	1.000	0.319	0.920	1.087
	Marital Status	-0.039	0.096	-0.038	-0.407	0.685	0.695	1.440
	Highest Qualification	0.020	0.044	0.037	0.459	0.647	0.922	1.084
	How long have you been living in Northern Nigeria?	0.014	0.027	0.042	0.528	0.598	0.948	1.054

Source: Authors' Computation, 2026.

As shown in Table 16, this presents the coefficients of a regression model examining the relationship between socio-demographic variables and third party insurance. The coefficient for marital status is statistically negative and significant effect on third party insurance with $B = 1.764$; $\beta = 0.321$ and $t = 5.499$; $p = 0.000$ respectively. The coefficient for age bracket is statistically negative and significant effect on third party insurance with $B = -0.186$; $\beta = -0.366$ and $t = -3.970$; $p = 0.000$ respectively. The coefficient for gender status is statistically positive and significant effect on third party insurance with $B = 0.273$; $\beta = 0.173$ and $t = 2.166$; $p = 0.032$ respectively. The coefficient for occupation engaged is statistically positive and insignificant effect on third party insurance with $B = 0.112$; $\beta = 0.080$ and $t = 1.000$; $p = 0.319$ respectively. The coefficient for Highest Qualification is statistically positive and insignificant effect on third party insurance with $B = 0.020$; $\beta = 0.037$ and $t = 0.459$; $p = 0.647$ respectively. The coefficient for length of residence in Northern Nigeria is statistically positive and insignificant effect on third party insurance with $B = 0.014$; $\beta = 0.042$ and $t = 0.528$; $p = 0.598$ respectively. However, only the gender status and age bracket are revealed to have changed the relationship with a significant increase and decrease respective in the third party insurance.

In addition, the values of tolerance and Variance Inflation Factor (VIF) among the independent variables reveal the presence of no multicollinearity. That is, age bracket, gender status, occupation engaged, marital status, highest qualification and length of residence reveal no multicollinearity as indicated from the table. Based on this, the diagnostics of multicollinearity reveal that there is no evidence of multicollinearity among the socioeconomic characteristics as indicated in the regression equation, which means the variables of the independent components are not highly related within each other, and there is reliable and stable estimation that interpretation of model is satisfied the assumption of regression in respect with multicollinearity.

Table 17. Model Summary for macroeconomic factors and economic growth.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.997 ^a	0.994	0.991	1585.56389

Source: Authors' Computation, 2026.

From Table 17, the association between all the independent variables and gross domestic products (GDP) is extremely strong with 0.997. Meanwhile, the variation in GDP is explained with 99.4% by the integration of the predictors. On average, the predicted GDP revealed an actual value of ₦1,585.56 billion. Nevertheless, government expenditures and taxes, trading business are likely to heavily overlapped.

Table 18. ANOVA^a for macroeconomic factors and economic growth.

	Model	Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	6697857470.941	6	1116309578.49	444.035	0.000 ^b
	Residual	42738218.618	17	2514012.86	N/A	N/A
	Total	6740595689.559	23	N/A	N/A	N/A

Source: Authors' Computation, 2025.

From Table 18, Fcal. and significance reveal 444.04 and 0.000 respectively, where p is lesser than 0.001. the model as a whole reveal to be statistically significant. Meanwhile, the integration of independent variables jointly reveals to predict GDP adequacy more than the use of an average alone i.e. R² is 99.4%.

Table 19. Coefficients^a for macroeconomic factors and economic growth.

	Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	14286.626	3090.679		4.622	0.000		
	Transport Services	392.618	219.068	0.346	1.792	0.091	0.010	99.771
	Government Expenditure	0.199	0.292	0.053	0.681	0.505	0.062	16.206
	Insurance Factors	8.918	28.787	0.031	0.310	0.760	0.036	27.623
	Education Access	-6.029	9.049	-0.157	-0.666	0.514	0.007	149.641
	Trading Business	3.634	0.909	0.731	3.998	0.001	0.011	89.682
	Government Taxes	1.222	5.319	0.019	0.230	0.821	0.055	18.153

a. Dependent Variable: Gross Domestic Products

Source: Authors' Computation, 2026.

From Table 19, the regression equation is created above as follows:

$$GDP = 14286.63 + 392.62\text{Transport Services} + 0.199\text{Government Expenditure} + 8.92\text{Insurance Factors} \\ + (-6.03)\text{Education Access} + 3.63\text{Trading Business} + 1.22\text{Government Taxes} + 0.60$$

The intercept as the constant reveals as B = 14,286.63, which is statistically positive and significant influence with t = 04.622 and p < 0.001 as the regression model explained on GDP variance. However, only Trading Business reveals a positive significant predictor of B = 3.634; β = 0.731; p = 0.001 on GDP. The comparison of the main variables is that Transport Services exhibits a larger standardized effect of B = 392.62; β = 0.346 than Insurance Factors with B = 8.918; β = 0.031, but neither reaches statistically positive and not significant effect at the 5% level with t = 1.792; p = 0.091 and t = 0.310 p = 0.760 respectively. In addition, government expenditure reveals a statistically positive and insignificant relationship with B = 0.199; β = 0.053; t = 0.681 and p = 0.505 on GDP. Government taxes reveals a statistically positive and insignificant relationship with B = 01.222; β = 0.019; t = 0.230 and p = 0.821 on GDP. Meanwhile, only educational accessibility has revealed a negatively statistics and insignificant association with B = -06.029; β = -0.157; t = -0.666 and p = 0.514 on GDP. However, only Trading Business as a predictor of macroeconomic factors is significantly predicted the GDP at the 0.05 level of significance.

More so, the values of tolerance and Variance Inflation Factor (VIF) among the independent variables reveal the presence of severe multicollinearity. That is, Transport Services reveals a severe multicollinearity as indicated from the table. In addition, Government Expenditure reveals a severe multicollinearity as well. Insurance Factors indicates a severe multicollinearity as indicated from the table as well. Trading Business and Government Taxes reveal a severe multicollinearity. Only the Education Accessibility reveals an extremely severe multicollinearity. Based on these results, the independent variables are highly correlated and related within another, which means the findings among the independent components as macroeconomic variables reveal very serious multicollinearity and coefficients of estimated regression is unstable and less reliable. Although, transport infrastructure shows greater relative association with GDP than third-party insurance, the evidence is insufficient to confirm a significant effect within this model.

4.3 Test of Hypothesis

Hypothesis One

H0₁: The socio-economic factors will not influence the infrastructure of transportation and insurance policy for thirty party at a particular entity and vice versa.

Table 20. Correlations analysis between socio-economic information; and transport infrastructure and third-party insurance.

N= 136			Age Bracket	Gender Status	Occupation Engaged	Marital Status	Highest Qualification	How long have you been living in Northern Nigeria?	Aggregate Transportation Infrastructure	Aggregate Third-party Insurance
Spearman's rho	Age Bracket	Correlation Coefficient	1.000	-0.201*	-0.053	0.547**	-0.244**	-.097	-.147	-.461**
		Sig. (2-tailed)	N/A	0.019	0.538	0.000	0.004	0.259	0.088	.000
	Gender Status	Correlation Coefficient	-0.201*	1.000	0.185*	-0.150	0.077	0.026	0.011	.259**
		Sig. (2-tailed)	0.019	N/A	0.031	0.081	0.373	0.767	0.899	.002
	Occupation Engaged	Correlation Coefficient	-0.053	0.185*	1.000	-0.162	0.147	0.088	-0.015	.137
		Sig. (2-tailed)	0.538	0.031	N/A	0.059	0.088	0.311	0.866	.111
	Marital Status	Correlation Coefficient	0.547**	-0.150	-0.162	1.000	-0.164	-0.137	-0.218*	-.282**
		Sig. (2-tailed)	0.000	0.081	0.059	N/A	0.056	0.113	0.011	.001
	Highest Qualification	Correlation Coefficient	-0.244**	0.077	0.147	-0.164	1.000	-0.100	-0.038	.165
		Sig. (2-tailed)	0.004	0.373	0.088	0.056	N/A	0.247	0.657	.054
	How long have you been living in Northern Nigeria?	Correlation Coefficient	-0.097	0.026	0.088	-0.137	-0.100	1.000	0.012	.155
		Sig. (2-tailed)	0.259	0.767	0.311	0.113	0.247	N/A	0.888	.071
	Aggregate Transportation Infrastructure	Correlation Coefficient	-0.147	0.011	-0.015	-0.218*	-0.038	0.012	1.000	.118
		Sig. (2-tailed)	0.088	0.899	0.866	0.011	0.657	0.888	N/A	.170
	Aggregate Third-party Insurance	Correlation Coefficient	-0.461**	0.259**	0.137	0.282**	0.165	0.155	0.118	1.000
		Sig. (2-tailed)	.000	0.002	0.111	0.001	0.054	0.071	0.170	.

Source: Authors' Computation, 2025.

From Table 20, the Spearman's rho correlations are computed to examine relationships between demographic variables and the study constructs with sample size of 136. The Aggregate Transportation Infrastructure shows non-significant association with demographic variables except Marital Status with $R = -0.218$ and $p = 0.011$, which this suggests a relatively uniform perception across groups. In contrast, Aggregate Third-party Insurance significantly correlates with Age Bracket with $R = -.0461$, $p < 0.001$, Gender Status with $R = 0.259$, and $p = 0.002$, and Marital Status with $R = -0.282$, and $p = 0.001$, revealing socio-economic demographic disparities in insurance uptake. Critically, Transportation Infrastructure and Third-party Insurance are not significantly correlated with $R = 0.118$, $p = 0.170$, which confirms that both of them are representing distinct dimensions.

Hypothesis Two

H0₂: There is no significant association between macroeconomic factors and gross domestic products (GDP) in Nigeria.

Table 21. Correlations analysis between macroeconomics factors and economic growth.

N =24		Gross Domestic Products	Transport Services	Government Expenditure	Insurance Factors	Education Access	Trading Business	Government Taxes
Gross Domestic Products	Pearson Correlation	1	0.964**	0.798**	0.959**	0.963**	0.988**	0.911**
	Sig. (2-tailed)	N/A	0.000	0.000	0.000	0.000	0.000	0.000
Transport Services	Pearson Correlation	0.964**	1	0.809**	0.886**	0.965**	0.935**	0.862**
	Sig. (2-tailed)	0.000	N/A	0.000	0.000	0.000	0.000	0.000
Government Expenditure	Pearson Correlation	0.798**	0.809**	1	0.743**	0.672**	0.726**	0.894**
	Sig. (2-tailed)	0.000	0.000	N/A	0.000	0.000	0.000	0.000
Insurance Factors	Pearson Correlation	0.959**	0.886**	0.743**	1	0.920**	0.971**	0.874**
	Sig. (2-tailed)	0.000	0.000	0.000	N/A	0.000	0.000	0.000
Education Access	Pearson Correlation	0.963**	0.965**	0.672**	0.920**	1	0.968**	0.799**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	N/A	0.000	0.000
Trading Business	Pearson Correlation	0.988**	0.935**	0.726**	0.971**	0.968**	1	0.882**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	N/A	0.000
Government Taxes	Pearson Correlation	0.911**	0.862**	0.894**	0.874**	0.799**	0.882**	1
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	0.000	N/A

Source: Authors' Computation, 2026.

From Table 21, the Pearson correlations extremely reveal high inter-correlations among all variables, $R > 0.750$, $p < 0.001$, which indicates extremely severe multicollinearity. Gross Domestic Product correlated most strongly with Trading Business, with $R = 0.988$ followed by Transport Services with $R = 0.964$, and Insurance Factors, with $R = 0.959$. While Transport Services exhibited a marginally stronger bivariate association with GDP than Insurance Factors with the two predictors shared 78.5% variation with $R = 0.886$. Due to multicollinearity, multiple regression produced unstable estimates. In separate bivariate models, Transport Services reveals to explain 92.9% of GDP variance compared to 92.0% for Insurance Factors, which this suggests that the transportation infrastructure has a slightly stronger relative effect on economic growth in Northern Nigeria.

4.4 Discussion of Findings

The correlation analysis reveals older respondents tend to be married and have lower qualifications, with males more likely to purchase third-party insurance in certain occupations. The married individuals tend to have lived in Northern Nigeria for a shorter period. Based on Table 10 - Table 12, the regression reveals a weak model fit of R^2 is equal to 6.6% with adjusted R^2 of 2.3%. Meanwhile, an overall reveals non-demographic variables, which do not meaningfully explain variations in transportation infrastructure perception. However, only marital status is significant, and even that effect is negatively revealed. Meanwhile, this finding is having a contrast with the previous studies such as Refs. [4,6,13,60], which consistently found that transportation infrastructure significantly drives economic growth, employment, and socio-economic well-being. Nevertheless, most of the prior studies relied largely on macro-level or time-series data such as national output, government spending, long-term trends, which this is similar to previous studies [59,62,65], but different from others as well [8,62,64]. Despite this, the analysis of this study is logically based on micro-level perceptions, and individuals' perceptions of infrastructure quality may not vary much across socio-economic groups, in the Spearman correlation results from Table 19 agree revealing mostly non-significant relationship. This reveals more closely an alignment with [64] that emphasized the complexity of measuring transportation infrastructure performance and the necessity for multidimensional methods rather than solely relying on demographic predictors.

On the side of third-party insurance, therefore, the findings are much more consistent with existing literature from Table 13 - Table 15, which is statistically significant with $p < 0.001$ a moderately explanatory power with R^2 of 23.6%. Age and gender emerge as significant predictors, which indicates demographic disparities in insurance uptake. This supports studies from the previous researchers such as Refs. [8,66,67], which highlight the role of socio-economic and demographic factors in shaping insurance demand and compliance. The findings that younger individuals and males are more likely to rate or adopt third-party insurance align with the broader argument that socio-economic characteristics influence insurance behavior. At the same point, the findings slightly differ from Ref. [66], where variables namely age was not significant. Although, Badru et al. [67] emphasized education and income, which this suggests the determinants of insurance uptake, where age, gender and marital status appear more influential than socio-economic predictors other than education or occupation.

From the GDP model of Table 16 - Table 20, the model indicates to be extremely strong with $R^2 = 99.4$, $F = 444.04\%$ & $p < 0.001$, which this support the previous studies such as Refs. [4,60] that found transportation significantly contributes to economic growth. However, the instability caused by multicollinearity has evidently revealed in the regression findings, where only the trading business is statistically significant, while transport services and insurance factors are not significant predictors despite having high correlations with GDP. In addition, the bivariate results indicate that transport services explains 92.2% of GDP variation slightly higher than insurance factors at 92.0%, which this supports the previous literatures' assertion that transportation is a stronger driver of economic growth with consistent assertion with [4,62,73] as an emphasis for centrality of transport infrastructure in economic expansion and investment attraction. Also, this is contrary to other studies [74-76].

However, the multivariate model fails to confirm this significance due to overlapping effects among predictors exactly what has been noted above. This also indirectly aligns with Ref. [61], which found no substantive relationship in a different insurance context, suggesting that financial/insurance variables do not always translate cleanly into macroeconomic outcomes when modeled alongside other factors. Finally, your correlation analysis (Table 19) confirms that transportation infrastructure and third-party insurance are statistically independent constructs ($r = 0.118$, $p = 0.170$). This supports the idea that they operate through different mechanisms: transportation affects physical and economic connectivity, while insurance relates more to risk management and financial protection. This distinction is important and aligns with Ref. [8] and Ref. [68], which frame insurance as behaviorally and culturally driven rather than structurally linked to infrastructure.

5. Conclusion

The results of this study establish to demonstrate that socioeconomic information have substantive limitations to affect the individuals' opinions on transportation infrastructure despite, the analyzed data correlated reveals some associations among demographic information (age, gender, marital status, education, occupation and length of residence), the findings from regression indicate that only a meager proportional variation has explained in transportation infrastructure perceptions. Only the marital status reveals to be statistically significant predictor with negative influence, which

suggests the transportation infrastructure perceptions are consistently relative across different socioeconomic collections, and demographic information are shaped beyond these factors as well as support consequently adopting multidimensional parameter instead of singlehandedly on demographic factors.

On the other hand, the explanation of third party insurance employs through demographic characteristics, demonstrating moderate explanatory power from the regression model. Where age and gender status significantly emerge as predictors that explain the uptake of insurance policy, which this reveals that demographic information affect individuals' ability to prudently purchase third party insurance. While males particularly in certain occupational groups were more likely to hold insurance coverage. These findings highlight the differentiated role of socio-demographic factors in shaping insurance behavior, as opposed to infrastructure perceptions. The results reveal to be consistently and generally aligned with previous researches, identifying socioeconomic and demographic variables as significant determinants of demand for insurance policy especially the compulsory third party insurance.

As regards to economic growth and development, the GDP equation has confirmed a strongly adequate association between related factors of transportation and economic growth. Although, there is highly exceptional coefficient determination reveals the explanatory variables that explain collectively on GDP. However, the individual regression coefficients' interpretation has weakened by the multicollinearity among the predictors, where only trading business indicates a statistically significant predictor in the multivariate equation. Although, the bivariate analysis reveals consistently that the account of transportation services is slightly much more variation on GDP than third party insurance, in which the conclusive reinforcement indicates that transportation infrastructure still remains a strongly viable driver for economic growth and investment than third party insurance.

More so, transportation infrastructure and third party insurance are statistically independent and significant constructs as established from correlation analysis, suggesting their contributions to economic growth and development from several pathways. Meanwhile, physical accessibility, productivity, trade, connectivity and investment are enhanced by transportation infrastructure, but the promotion of financial security, regulatory compliance and risk management practices are defined by third party insurance, which these may not necessarily need the integration before improving one sector and the other.

Generally, the study concludes that socioeconomic growth and development is distinctively and complementarily contributed by transportation infrastructure and third party insurance in terms of directly and substantively influencing on economic growth and strengthening and supporting financial security and economic stability respectively. These findings provide insights into the relationships between socio-economic information, in comparison between transportation infrastructure and third party insurance purchases in Northern Nigeria. In conclusion, there is directly moderate relationship and statistically non-significant relationship between socio-economic information and transportation infrastructure. On the other hand, there is directly moderate relationship and statistically significant relationship between socio-economic information and third party insurance. The study concludes that older respondents tend to be married with lower qualifications. The males in certain occupations are more likely to purchase third-party insurance. The Married individuals have shorter residency in Northern Nigeria.

6. Recommendations

Based on the results of this study, transportation infrastructure and third-party insurance have distinctively integrated to complement the economic growth in Northern Nigeria. This leads to have proposed for the suggested recommendations below.

6.1 Prioritization of Sustainable Investment in Transportation Infrastructure

The study has shown that transportation infrastructure found to strongly drive the economic growth than third party insurance. Therefore, all levels of government should elevate the construction investments in the infrastructural projects namely construction, road maintenance, rehabilitation, railways, bridges and ports in order to improve connectivity, trade facilitation, transportation costs reductions, private investment attraction and sustainable economic growth stimulation.

6.2 Multidimensional Performance Indicators of Transportation Policies

The policymaker should have adopted broader indicators in order to evaluate transportation performance through reliability, accessibility, quality services, safety, affordability and environmental sustainability as well as user relationship and satisfaction.

6.3 Improvement of Qualitative Transport Services

Government agencies and operators across all levels should mainly focus on the improvement of road safety, operational efficiency and culture maintenance, traffic management services, and integrating different modes of transport operations in order to increase public and passengers' confidence through maximization of economic benefits.

6.4 Public Enlightenment on Compulsorily Mandatory Third-Party Insurance Policy

The economic players of transportation namely insurance regulators and companies, transport authorities should have intensified public awareness campaigns through workshops, and seminars on the legal requirements, statutory benefits, and financial security built on motor vehicle insurance especially third-party insurance in order to capture different demographic settings.

6.5 Regulatory Enforcement of Compulsorily Mandatory Third-Party Insurance Policy

Government agencies that are responsible for road transport and insurance regulatory supervision should have improved the system of monitoring transport operations in order to eliminate the non-genuine insurance certificate, improve platforms for digital verification, and enforce regulatory compliance on any compulsory insurance rules and regulations so that public satisfaction, relationship and confidence will have existed in the insurance industry.

6.6 Supportive Operations for Trading and Commercial Enterprises

Government should have improved transportation logistics, commercial infrastructures and market accessibility that will facilitate and expand internal, and regional trading businesses.

Authors' Contributions

All authors contributed to this study. Conceptualized work, Najimu A. Nafiu; methodology, Adewale E. Adegoriola, Najimu A. Nafiu; software, Adewale E. Adegoriola, Najimu A. Nafiu; validation, Adewale E. Adegoriola, Najimu A. Nafiu; formal analysis Adewale E. Adegoriola, Najimu A. Nafiu; investigation, Adewale E. Adegoriola; resources and data, Adewale E. Adegoriola, Najimu A. Nafiu; discussed work, Adewale E. Adegoriola, Najimu A. Nafiu; writing-Original draft preparation, Adewale E. Adegoriola, Najimu A. Nafiu; writing-Reviewing and editing, Adewale E. Adegoriola, Najimu A. Nafiu; supervision, Adewale E. Adegoriola; work administration, Adewale E. Adegoriola; funding acquisition, Adewale E. Adegoriola, Najimu A. Nafiu. All authors have read and agreed to the published version of the manuscript.

Declaration of Interests

The authors have declared no competing conflict of interest.

Acknowledgements

No acknowledgements declared by the authors.

Funding

Not applicable

Data Availability

The supporting data for the results of this study are available from the corresponding author upon reasonable request.

Ethics Statement

The approval for ethical statement was not applicable to this research.

AI Statements

The authors declare that no artificial intelligence techniques were adopted in the research, analysis, or preparation of this manuscript.

References

- [1] Okiche EL. Protection of consumers of transportation services under the motor vehicles (third party insurance) act in Nigeria. *The Nigerian Judicial Review*, 2013, 11, 19-38.
- [2] Thacker S, Adshead D, Morgan G, Crosskey S, Bajpai A, Ceppi P, et al. *Infrastructure: Underpinning sustainability development*. United Nations Office for Project Services: Copenhagen, Denmark, 2018.

- [3] Adebosin WG, Salami LA, Saula DT. Investment in road transport infrastructure and economic growth in Nigeria: A vector error correction model approach. *Journal of Economics and Allied Research*, 2022, 7(2), 81-92.
- [4] Kaiser N, Barstow CK. Rural transportation infrastructure in low- and middle- income countries: A review of impacts, implications, and interventions. *Sustainability*, 2022, 14(4), 2149. DOI: 10.3390/su14042149
- [5] Fedderke JW, Bogetic Z. Infrastructure and growth in South Africa: Direct and indirect productivity impacts of 19 infrastructure measures. *World Development*, 2009, 37(9), 1522-1539. DOI: 10.1016/j.worlddev.2009.01.008
- [6] Ebelechukwu AO, Victor OI, Sunday OC, Okoye NJ, Okere W. Transportation infrastructure development and Nigeria's economy: An empirical investigation. *International Journal of Social Science, Technology and Economics Management*, 2024, 1(2), 330-338. DOI: 10.59781/RIPI3024
- [7] Mannis A. Indicators of sustainable development. Environmental Software and Services GmbH AUSTRIA, 1998.
- [8] Adeyemo DL, Ekundayo OA, Onatola SA, Adebayo OA. Motor vehicle (third party) insurance regulation and road traffic liability risk management in Nigeria. *JABU International Journal of Social and Management Sciences*, 2022, 8(2), 173-186.
- [9] Olayinka AI, James BO, Hammed OT, Olayemic OJ, Oyeleye M, Victor OA. Impact of road transportation on economic growth in Oyo state, Nigeria. *Journal of Management Sciences*, 2024, 61(7), 211-221.
- [10] Ajakaiye O, Ncube M. Infrastructure and economic development in Africa: An overview. *Journal of Africa Economies*, 2010, 19(1), i3-i12. DOI: 10.1093/jae/ejq003
- [11] Obayelu AE, Olarewaju TO, Oyelami NL. Effect of rural infrastructure on profitability and productivity of cassava based farms in Odogbolu Local Government, Ogun State, Nigeria. *Journal of Agricultural Science, Belgrade*, 2014, 59(2), 187-200. DOI: 10.2298/JAS1402187O
- [12] Weiss TG, Forsythe DP, Coate RA, Pease K. The United Nations and changing world politics. Westview Press, 2013.
- [13] Baba YN, Abdulrahman M. The effect of transport infrastructure development on the socioeconomic wellbeing of Baro residents: A study of Baro inland port in Niger State. *Lapai Journal of Economics*, 2024, 8(1), 205-213. DOI: 10.4314/lje.v8i1.14
- [14] Ke X, Lin JY, Fu C, Wang Y. Transport infrastructure development and economic growth in China: Recent evidence from Dynamic panel system-GMM analysis. *Sustainability*, 2020, 12(14), 5618. DOI: 10.3390/su12145618
- [15] Levinson D, Liu H, Garrison W, Danczyk A, Corbett M, Dixon K. Fundamentals of transportation. Wikipedia, 2010.
- [16] Central Bank of Nigeria. Data and Statistics, 2023. Available from <https://www.cbn.gov.ng/rates/>: 19 October 2025.
- [17] Apere TO. Marketing motor insurance policy and economic growth in Nigeria. *EBSU Journal of Social Sciences and Humanities*, 2024, 14(1), 109-118.
- [18] Ebelechukwu AO, Victor OI, Sunday OC, John ON, Wisdom O. Transportation infrastructure development and Nigeria's economy: An empirical investigation. *International Journal of Social Science, Technology and Economics Management*, 2024, 1(2), 330-338. DOI: 10.59781/RIPI3024.
- [19] Alam MM. Creating pro-poor transport: Connecting the dots-transport, growth, and poverty reduction. World Bank, 2015, 24. DOI: 10.1596/25003
- [20] Ola AE. The impact of transportation on economic development in Nigeria. *International Journal of Contemporary Applied Researches*, 2018, 5(8), 140-154.
- [21] Ochei MC, Mamudu ZU. Analysis of the contributions of transport sector to economic growth in Nigeria. *IOSR Journal of Economics and Finance*, 2020, 11(6), 18-35. DOI: 10.9790/5933-1106031835
- [22] Ghosh PK, Dinda S. Revisited the relationship between economic growth and transport infrastructure in India: An empirical study. *The Indian Economic Journal*, 2021, 70(1), 34-52. DOI: 10.1177/00194662211063535
- [23] Barro RJ. Government spending in a simple model of endogenous growth. *Journal of Political Economy*, 1990, 98(5), 103-125. DOI: 10.1086/261726
- [24] Romer PM. Increasing returns and long-run growth. *Journal of Political Economy*, 1986, 94(5), 1002-1037. DOI: 10.1086/261420
- [25] Krugman P. Increasing returns and economic geography. *Journal of Political Economy*, 1991, 99(3), 483-499. DOI: 10.1086/261763
- [26] Quickonomics. Third-party insurance, 2024. Available from: <https://quickonomics.com/terms/third-party-insurance/>: 19 October 2025.
- [27] Tamplin T. Third-party insurance. Finance Strategists, 2023. Available from: <https://www.financestrategists.com/insurance-broker/property-and-casualty-insurance/third-party-insurance/>: 19 October 2025.
- [28] Kagan J. Third-party liability insurance types. Investopedia, 2025. Available from: <https://www.investopedia.com/terms/t/third-party-insurance.asp>: 19 October 2025.
- [29] Arrow KJ. Uncertainty and the welfare economics of medical care. *American Economic Review*, 1963, 53(5), 941-973.
- [30] Outreville JF. The relationship between insurance and economic development: 85 empirical papers for a review of the literature. *Risk Management and Insurance Review*, 2013, 16(1), 71-122. DOI: 10.1111/j.1540-6296.2012.01219.x
- [31] Grant I. Socioeconomic factors and their influence on human development. *Journal of Stem Cell Research & Therapy*, 2025, 14(3), 1-2. DOI: 10.35248/2167-0358.25.14.280
- [32] Rodrigue JP. The Geography of Transport Systems (5th ed.). Routledge, 2020. DOI: 10.4324/9780429346323
- [33] Arvis JF, Ojala L, Wiederer C, Shepherd B, Raj A, Dairabayeva K, et al. Connecting to Compete 2018, Trade Logistics in the Global Economy. World Bank Group, 2018. DOI: 10.1596/29971
- [34] African Development Bank. African Economic Outlook 2018. African Development Bank Group, 2018.
- [35] Musgrave RA, Musgrave PB. Public finance in theory and practice (5th ed.). New York: McGraw-Hill Book Co, 1989.
- [36] Keynes JM. The general theory of employment, interest and money. International Relations and Security Network, 1936, 1-190.
- [37] World Bank. (2022). World Development Report 2022: Finance for an equitable recovery. World Bank Group. <https://www.worldbank.org/en/publication/wdr2022>
- [38] Ward D, Zurbrugg R. Does insurance promote economic growth? Evidence from OECD countries. *Journal of Risk and Insurance*, 2000, 67(4), 489-506. DOI: 10.2307/253847
- [39] Haiss P, Sumegi K. The relationship between insurance and economic growth in Europe: a theoretical and empirical analysis. *Empirica*, 2008, 35(4), 405-431. DOI: 10.1007/s10663-008-9075-2
- [40] Rejda GE, McNamara MJ, Rabel WJ. Principles of risk management and insurance (14th ed.). Pearson, 2022.

- [41] Arena M. Does insurance market activity promote economic growth? A cross-country study for industrialized and developing countries. *Journal of Risk and Insurance*, 2008, 75(4), 921-946. DOI: 10.1111/j.1539-6975.2008.00291.x
- [42] Becker GS. Human capital: A theoretical and empirical analysis, with special reference to education. National Bureau of Economic Research, 1964.
- [43] Schultz TW. Investment in human capital. *American Economic Review*, 1961, 51(1), 1-17. DOI: 10.3386/w0033
- [44] World Bank. (2018). World Development Report 2018: Learning to realize education's promise. World Bank Group. <https://www.worldbank.org/en/publication/wdr2018>
- [45] Hanushek EA, Woessmann L. The knowledge capital of nations: Education and the economics of growth. MIT Press, 2015.
- [46] Todaro MP, Smith SC. Economic development (13th ed.). Pearson, 2021.
- [47] Ricardo D. On the principles of political economy and taxation-1817. Dover Publications, 1817.
- [48] Banister D, Berechman Y. Transport investment and the promotion of economic growth. *Journal of Transport Geography*, 2001, 9(3), 209-218. DOI: 10.1016/S0966-6923(01)00013-8
- [49] World Bank. (2024). Global Economic Prospects. World Bank Group. <https://www.worldbank.org/en/publication/global-economic-prospects>
- [50] Organisation for Economic Co-operation and Development. Tax policy reforms 2021: Special edition on tax policy during the COVID-19 pandemic. OECD Publishing, Paris. 2021. DOI: 10.1787/427d2616-en
- [51] Mankiw NG. Principles of economics (9th ed.). Cengage Learning, 2021.
- [52] World Bank. World Development Indicators. World Bank Group. 2024.
- [53] Konno A, Kato H, Takeuchi W, Kiguchi R. Global evidence on productivity effects of road infrastructure incorporating spatial spillover effects. *Transport Policy*, 2021, 103, 167-182. DOI: 10.1016/j.tranpol.2021.02.007
- [54] Varghese AM, Pradhan RP. Transportation infrastructure and economic growth: Does there exist causality and spillover? A Systematic Review and Research Agenda. *Transportation Research Procedia*, 2025, 82, 2618-2632. DOI: 10.1016/j.trpro.2024.12.208
- [55] Calderón C, Servén L. Infrastructure, growth, and inequality: An overview. Policy Research Working Paper Series 7034, The World Bank, 2014.
- [56] Holmstrom B, Tirole J. Liquidity and risk management. *Journal of Money, Credit and Banking*, 2000, 32(3), 295-319. DOI: 10.2307/2601167
- [57] Giambona E, Graham JR, Harvey CR, Bodnar GM. The theory and practice of corporate risk management: Evidence from the field. *Financial Management*, Winter, 2018, 783-832. DOI: 10.1111/fima.12232
- [58] Wikipedia. (2026). Strategy of unbalanced growth. Wikimedia. https://en.wikipedia.org/wiki/Strategy_of_unbalanced_growth
- [59] Adebayo EA, Agum C. Impact of road transportation on Nigerian economic growth: 1985-2022. 2023.
- [60] Isimoya OA, Akindipe EA. Gross premium income and claims settlement of marine and aviation insurance in Nigeria: A Panel Approach. *Acta Universitatis Danubius*, 2022, 18(6), 108-118.
- [61] Ogundipe AA, Oye QE, Ogundipe OM, Osabohien R. Does infrastructure absorptive capacity stimulate FDI-growth nexus in ECOWAS? *Cogent Economics and Finance*, 2020, 8(1), 1751487. DOI: 10.1080/23322039.2020.1751487
- [62] Ojide MG, Oyedele OA, Ukwueze ER, Ikpeze NI. Evaluating the effect of road infrastructure on household income in Ogoni community, River State, Nigeria. *Journal of Economics and Allied Research*, 2016, 1(1), 93-105.
- [63] Skorobogatova O, Kuzmina-Merlino I. Transport infrastructure development performance. *Procedia Engineering*, 2017, 178, 319-329. DOI: 10.1016/j.proeng.2017.01.056
- [64] Ajemunigbohun SS, Oreshile AS. Risk attitude and demand for motor insurance: An examination of selected motorists in Lagos State, Nigeria. *Development Country Studies*, 2014, 4(21), 144-153.
- [65] Abdul-Fatawu M, Logubayom AI, Abonongo J. Determinants of the demand for life insurance in the Northern region of Ghana- A study of the Tamale metropolis. *The Journal of Risk Management and Insurance*, 2019, 23(1), 52-69.
- [66] Fadun OS, Isimoya OA, Ugwuoke AO. Socio-economic determinants of life assurance purchase in Nigeria. *EKSU Journal of the Management Sciences*, 2024, 3(1), 288-306.
- [67] Badru FA, Yusuf TO, Isola W. Socio-cultural factors affecting insurance patronage in Lagos State, Nigeria: An exploratory study. *African Journal of Accounting, Economics, Finance and Banking Research*, 2013, 28, 43-55.
- [68] Dawodu AW. Evaluating the impact of road infrastructure on motor insurance claims: Empirical evidence from Lagos state, Nigeria. *Journal of Social Sciences & Humanities*, 2025, 10(2), 219-230.
- [69] Enyinda CA. Trend of motor accident insurance claims in Nigeria. *Fuoye Journal of Finance and Contemporary Issues*, 2022, 2(1), 63-71.
- [70] Adepoju OO. Analysis of road transportation infrastructure construction and maintenance for sustainable development in South-Western Nigeria. *Journal of Sustainable Development of Transport and Logistics*, 2021, 6(1), 49-58. DOI: 10.14254/jsdtl.2021.6-1.4
- [71] Dagare S. The impact of government spending on economic development: A comprehensive study of public expenditure and its role in national growth. *Integrated Journal for Research in Arts and Humanities*, 2026, 33-37. DOI: 10.55544/ijrah.dyparts.7
- [72] Ahmad H, Sadeeqe J, Farooq U, Hayat U, Haroon U. Fiscal policy determinants impact on the economic growth with the moderating role of the exchange rate and inflation rate: Evidence from an emerging economy. *Journal of Excellence in Management Sciences*, 2024, 3(3), 68-81. DOI: 10.69565/jems.v3i3.317
- [73] Owuna AA, Henry EA, Odonye OJ. Impact of insurance sector on economic growth in Nigeria. *Polac Management Review*, 2024, 4(2), 36-48.
- [74] Fadun OS. Analysis of the impact of insurance claims settlement on economic growth in Nigeria. *International Journal of Business Ecosystem & Strategy*, 2023, 5(3), 51-59. DOI: 10.36096/ijbes.v5i3.424
- [75] Fadun OS, Silwimba P. Does insurance promote economic growth? Evidence from Nigeria. *Nigeria Journal of Risk and Insurance*, 2023, 13(1), 1-24.
- [76] Oloyede JA, Folorunsho A, Ogamien OF. The Impact of Insurance on Economic Growth in Nigeria. *Nigerian Journal of Banking and Financial Issues*, 2023, 9(1), 1-8.
- [77] Creswell JW, Creswell JD. Research design: Qualitative, quantitative, and mixed methods approaches (5th ed.). Sage Publications, Los Angeles, 2018.
- [78] Saunders M, Lewis P, Thornhill A. Research methods for business students (8th ed.). Pearson, 2019.