

ECONOMIC IMPACT OF DUALIZATION OF NNEWI-OKIJA ROAD IN ANAMBRA STATE, NIGERIA

*Anene, W.C.¹, Ikpa, P.N.², Nwakile, P.C.³, Chukwuanu, C.P.⁴, Arugbuonye, S.C.⁵,
Obunikem, I.K.⁶

¹Lecturer, Department of Civil Engineering, Chukwuemeka Odumegwu Ojukwu University, Anambra State, Nigeria.

²Lecturer, Department of Civil Engineering, Federal University of Technology, Owerri, Imo State, Nigeria.

^{3,4,5,6}Student, Department of Civil Engineering, Chukwuemeka Odumegwu Ojukwu University, Anambra State, Nigeria.

*Corresponding Author: anenewalter@gmail.com

ABSTRACT

Road infrastructure drives economic development by facilitating trade, mobility, and regional integration. In Nigeria, poor road networks and traffic inefficiencies limit productivity and growth. This study examines the economic impact of the Nnewi-Okija Road dualization in Anambra State, a key corridor linking commercial and industrial centers. Using a mixed-methods approach with 250 respondents, data were collected via questionnaires, interviews, focus group discussions, and field observations, and analyzed with Pearson correlation. Results show strong positive associations between road dualization and economic indicators: business income improvement ($r = 0.68$), property/land value increase ($r = 0.81$), and reduced transport costs ($r = 0.92$). Travel time under 30 minutes increased from 10% to 58%, while trips over 60 minutes fell from 54% to 12%. Approximately 68% of businesses reported improved performance, with 65% experiencing revenue growth above 10%, and 24% gaining 31-50%. The project also spurred new economic activity: 71% noted new businesses, 81% reported higher property values, 74% observed improved transport services, and 56% gained employment, despite 48% experiencing temporary disruptions. Field observations confirmed smoother traffic flow, increased commerce, and visible infrastructure development. The study concludes that dualization of the Nnewi-Okija Road significantly improved transport efficiency, business performance, and regional development. Recommendations include regular maintenance, traffic management enhancements, and support for local enterprises, complementary infrastructure development, and ongoing stakeholder engagement to sustain and maximize long-term economic benefits.

Key words: Road Dualization, Economic Impact, Transport Efficiency, Business Performance, Infrastructure Development

1.0 INTRODUCTION

An effective road network is crucial for economic development, facilitating trade, transportation, and mobility. In Nigeria, road construction is a major component of transport infrastructure, enabling the movement of goods, services, and people, thereby enhancing productivity and integration. Many emerging economies including China, Singapore, and Taiwan have achieved significant poverty reduction and economic growth through sustained investment in road infrastructure (Zhou et al., 2022). Early studies by Aschauer (1989) and Munnell (1992) demonstrated that public infrastructure investment enhances productivity, while Gramlich (1994) emphasized its role in reducing production costs. More recent research shows that infrastructure investments in developing countries yield high economic returns (Fay & Morrison, 2007; Calderón & Servén,

2010), reduce trade costs, and support competitiveness (Leipzig et al., 2003; Estache, 2005; World Bank, 2023; Duranton & Turner, 2012). In Africa, transport infrastructure is vital for regional integration and development (Rodrigue, 2020; Collier, 2007; Sachs, 2005).

In Nigeria, however, road conditions remain poor, constraining economic growth (Adedeji, 2002; Soludo, 2007). Local studies reveal significant gaps in drivers' understanding of traffic rules and inefficiencies in traffic management (Anene., 2022; Anene *et al.*, 2022; Anene *et al.*, 2023a; Anene *et al.*, 2023b). Rapid urbanization has exacerbated congestion, while single carriageways are unable to accommodate growing traffic volumes, reducing urban mobility and productivity (Downs, 2004; Ibrahim *et al.*, 2019; Small & Verhoef, 2007; Button, 2010).

Highways play a critical role in economic connectivity, and road enhancement through proper management, upgrading, and dualization improves traffic flow and urban economic growth (Onyeneke, 2018; Richardson, 2013). Integrated planning, including pedestrian infrastructure, further alleviates congestion in high-density areas (Ogunjiofor, *et al.*, 2026). Infrastructure improvements also influence land-use development, property values, and urban productivity (Cervero, 1998; Ewing, 2008; Glaeser, 2011). Nonetheless, road expansion faces challenges such as cost overruns, social disruption, and environmental concerns (Flyvbjerg, 2009; Banister, 2008; Ajagbe *et al.*, 2019), while poor drainage reduces pavement lifespan and increases maintenance costs (Anene *et al.*, 2026).

The Nnewi–Okija road in Anambra State is a vital link connecting commercial and industrial centers. Its current single-lane configuration causes severe congestion, delays, and limited market access, adversely affecting trade and increasing transport costs (Calderón & Servén, 2010; Rodrigue, 2020). Local studies confirm that traffic management deficiencies, poor road design, and inadequate support infrastructure contribute to transport inefficiency (Anene W.C. *et al.*, 2022-2026). These challenges reflect broader infrastructural issues in Nigeria, where poor roads hinder business expansion and reduce competitiveness (Collier, 2007).

Dualization of the Nnewi–Okija road is expected to improve traffic flow, reduce travel time, and boost economic activities, including commerce, agriculture, and tourism. Evidence from other contexts indicates that road expansion enhances accessibility and reduces transport costs (Duranton and Turner, 2012; World Bank, 2023). However, empirical evidence quantifying the economic impact of this dualization is limited. This study aims to examine the economic implications of the Nnewi-Okija Road dualization, focusing on its effects on local businesses, employment, agricultural productivity, and overall development, providing insights for policymakers and stakeholders.

2.0 MATERIALS AND METHODS

This study employed a mixed-methods research design, combining quantitative and qualitative approaches to examine the economic impact of the Nnewi–Okija Road dualization in Anambra State, Nigeria. The research was structured as a descriptive and analytical survey, capturing stakeholders' perceptions and examining trends in business growth, transport costs, property values, and employment.

The study area covered Nnewi North, Nnewi South, and Ihiala Local Government Areas, which are directly affected by the road corridor. The population included residents, business owners, transport operators, government officials, real estate developers, and other indirect beneficiaries. A sample of 250 respondents was selected using purposive and stratified random sampling to ensure representation across stakeholder groups and locations.

Data were collected using structured questionnaires, in-depth interviews, focus group discussions (FGD's), and field observations, conducted over four weeks with trained research assistants. Quantitative data were analyzed using descriptive statistics and Pearson Product Moment Correlation (PPMC) to assess relationships between road dualization and economic indicators. Qualitative data were analyzed thematically to identify key patterns and stakeholder insights. Findings were presented through tables, charts, and narrative summaries to provide a comprehensive understanding of the road's economic impact.

3.0 RESULTS AND DISCUSSION

This chapter presents the results obtained from the analysis of the data collected through structured questionnaires, interviews, focus group discussions (FGDs), and field observations. The results are organized into three major sections: demographic characteristics of respondents, economic impacts of the road dualization, and stakeholders' perceptions and suggestions. Quantitative data are presented using frequency tables, percentages, and charts, while qualitative findings are summarized thematically. Pearson Product Moment Correlation (PPMC) was employed to examine relationships between road dualization and economic indicators.

Table 1: Demographic Characteristics of Respondents

Gender Distribution		
Gender	Frequency	Percentage
Male	162	64.8%
Female	88	35.2%
Total	250	100%
Age Distribution		
Age Group	Frequency	Percentage
18-30	60	24%
31-45	104	41.6%
46-60	58	23.2%
60+	28	11.2%
Occupational Distribution		
Occupation	Frequency	Percentage
Business owner	86	34.4%
Transport worker	50	20%
Real Estate Developer	18	7.2%
Civil Servant	36	14.4%
Resident	46	18.4%
Other	14	5.6%

The gender distribution shows that males (64.8%) formed the majority of the respondents. This is likely because sectors most affected by road dualization—such as transport, construction, and logistics—are male dominated. The relatively lower percentage of females (35.2%) suggests that women are either less involved in these sectors or less accessible during field data collection. Nonetheless, the female responses still offer valuable perspectives, especially from market traders and residents.

The age group 31-45 years (41.6%) dominates, followed by 18-30 years (24%). This confirms that the economically active population is most impacted by the road project. These groups are typically involved in commerce, daily commuting, and property transactions. The older age group (60+) forms the smallest proportion, possibly because they are less involved in active economic ventures and mobility. The age distribution ensures a reliable cross-section of responses across economic roles and experience levels.

Business owners constitute the largest group of respondents (34.4%), followed by transport workers (20%). This aligns with the study’s focus on economic impact, since businesses and transport services are directly affected by road infrastructure. Real estate developers (7.2%) and civil servants (14.4%) provide insights into policy and investment-related aspects. The diversity in occupational backgrounds ensures a balanced view of both private and public sector experiences.

Table 2: Economic Impact of Road Dualization

Travel Time Before and After Dualization			
Travel Time	Before (%)	After (%)	
<30 mins	10%	58%	
30-60 mins	36%	30%	
61-90 mins	32%	8%	
>90 mins	22%	4%	
Travel Time Before and After Dualization			
Indicator	Frequency	Percentage	
Business improved	170	68%	
Revenue increase <10%	24	14.1%	
Revenue increase 10-30%	52	30.6%	
Revenue increase 31-50%	41	24.1%	
Revenue increase >50%	18	10.6%	
Not sure	35	20.6%	
Business Performance Post-Dualization			
Indicator	Frequency	Percentage	
Business improved	170	68%	
Revenue increase <10%	24	14.1%	
Revenue increase 10-30%	52	30.6%	
Revenue increase 31-50%	41	24.1%	
Revenue increase >50%	18	10.6%	
Not sure	35	20.6%	
Emergence of New Businesses and Infrastructure			
Response	Yes	No	Not sure
New businesses opened	71%	19%	10%
Increase in building development	63%	27%	10%
Transport cost reduce/increased service	74%	14%	12%
Land/property value increase	81%	10%	9%
Employment from road project	56%	30%	14%
Faced disruption during construction	48%	48%	4%

In Travel Time Before and After Dualization, there is a dramatic reduction in travel time after road dualization. Before the project, only 10% of commuters could travel within 30 minutes. After dualization, this rose to 58%. The percentage of commuters spending over an hour dropped from 54% (32% + 22%) to just 12%. This signifies enhanced mobility, reduced traffic congestion, and improved logistics efficiency. Such time savings directly benefit businesses, transporters, and commuters by increasing productivity and reducing costs. The travel time between Nnewi and Okija significantly reduced after dualization. Prior to the upgrade, over 54% of respondents took more than 1 hour. Now, 88% spend under 1 hour, with over half (58%) spending less than 30 minutes. This improvement supports economic activities by reducing delays and transport costs.

Response on business performance post-dualization, revealed that a clear majority (68%) reported improved business performance following the dualization of the Nnewi–Okija Road. About 65% experienced revenue increases above 10%, with 24.1% recording substantial gains of 31–50%, while 20.6% were unsure of the exact increase.

For emergence of new businesses and infrastructure, the responses indicate a positive economic transformation along the Nnewi–Okija corridor. 71% observed new businesses springing up, validating the road's impact on entrepreneurship. 81% agreed that land and property values have risen a common effect of improved accessibility and infrastructure. 74% noted an increase in transport frequency and affordability, showing the road is serving its mobility function. 56% reported employment benefits, mostly in construction, trading, and transport services. Despite 48% experiencing temporary disruption during construction, the net outcome is highly favorable from an economic standpoint. The dualization spurred new businesses, real estate development, and job creation. Increased property values and building activities suggest economic revitalization. Although 48% reported disruptions during construction, the long-term benefits appear to outweigh temporary inconveniences.

Overview of Major Findings

The dualization of the Nnewi–Okija Road significantly improved mobility, business performance, and economic development. Commuters spending under 30 minutes rose from 10% to 58%, while over-one-hour trips dropped from 54% to 12%, showing reduced travel time and congestion. A majority (68%) of businesses reported improved performance, with 65% seeing revenue growth above 10% and 24% achieving gains of 31–50%. The project also stimulated economic transformation. 71% noted new businesses, 81% observed higher property values, 74% reported better transport services, and 56% gained employment, despite temporary construction disruptions.

These findings align with the broader results, where high positive responses (mostly **above 75%**) were recorded across key areas such as traffic flow, economic activities, transport efficiency, and property development. The dualization of the road significantly improved transport efficiency, facilitated commerce, and stimulated local economic growth. The findings indicate that the project has positively influenced business performance, enhanced economic activities, and contributed to the overall development of the surrounding communities.

Table 3: Perceptions and Stakeholders' Feedback (Qualitative Analysis)

S/N	Category	Interview / FGD Questions	Response	%Positive Response
1	General Perception	How would you describe the condition of the Nnewi-Okija Road before and after its dualization?	The road has improved significantly, from a narrow and congested route to a wide, smooth dual carriageway	97
2	General Perception	What are your overall impressions of the dualized road project?	The project is highly commendable and has greatly enhanced transportation and economic activities	93
3	General Perception	In your opinion, has the road project brought noticeable changes to the area? Please explain.	Yes, it has brought major improvements in mobility, business growth, and overall development.	96
4	Traffic Flow & Accessibility	How has the dualization affected traffic flow along the road?	Traffic flow is now smoother with reduced congestion and fewer delays.	87
5	Traffic Flow & Accessibility	Have you experienced any changes in travel time since the road was expanded?	Yes, travel time has reduced considerably, making movement faster and more efficient	88
6	Traffic Flow & Accessibility	To what extent has the road improved connectivity between communities?	Connectivity between communities has improved greatly, making access easier and quicker	90
7	Economic Activities	Have you observed any changes in business activities along the road corridor?	Yes, there is a noticeable increase in business activities along the corridor	91
8	Economic Activities	How has the improved road affected the movement of goods and services?	It has facilitated faster and more efficient movement of goods and services.	89
9	Economic Activities	Has there been any increase in customer patronage or sales in your business?	Yes, customer patronage and sales have increased significantly.	76
10	Economic Activities	In what ways has the road influenced local markets and trading activities?	It has boosted market activities and attracted more traders and customers.	87
11	Business Growth & Investment	Has the road dualization created new business opportunities?	Yes, it has created numerous new business opportunities.	80
12	Business Growth & Investment	Have you expanded your business or plan to expand due to the improved road?	Yes, business expansion has been encouraged due to improved accessibility.	77

13	Business Growth & Investment	Have you noticed an increase in new businesses or investments along the road?	Yes, there is a clear rise in new businesses and investments in the area.	75
14	Transport & Costs	How has the dualized road affected transport operations?	Transport operations have become more efficient and reliable.	93
15	Transport & Costs	Have vehicle operating costs (fuel, maintenance) changed since the improvement?	Yes, vehicle operating costs have reduced due to better road conditions.	91
16	Transport & Costs	What impact has the road had on transport fares or logistics efficiency?	It has improved logistics efficiency and helped stabilize transport fares.	92
17	Property Value & Development	Have property values changed since the road dualization?	Yes, property values have increased significantly.	90
18	Property Value & Development	Have you observed increased land or real estate development?	Yes, there is noticeable growth in land and real estate development.	94
19	Property Value & Development	What new developments have emerged along the road corridor?	New shops, markets, residential buildings, and commercial centers have emerged.	73
20	Livelihood Impact	How has the road project affected your income or standard of living?	It has improved income levels and overall standard of living.	79
21	Livelihood Impact	Has the road improved access to jobs, markets, or services?	Yes, access to jobs, markets, and essential services has improved.	71
22	Livelihood Impact	What impact has the road had on daily commuting experiences?	Daily commuting is now easier, faster, and more comfortable.	88
23	Regional Integration	Has the road improved economic links between towns and regions?	Yes, it has strengthened economic connections between towns and regions	84
24	Regional Integration	What long-term economic benefits do you foresee from this project?	It will promote sustained economic growth, investment, and regional development.	75
25	Regional Integration	Has the road contributed to overall economic growth in the area? Why?	Yes, it has stimulated economic growth by enhancing trade and mobility.	77
26	Closing	What additional improvements would you suggest to enhance the road's economic benefits?	Further maintenance, street lighting, and traffic control measures would enhance its benefits.	96

Interviews and Focus Group Discussions (FGDs) were conducted, comprising local business owners, transport operators, commuters, and community leaders to assess the economic impact of the dualization of the Nnewi-Okija Road in Anambra State. The findings, as presented in the table above, indicate a consistently high level of positive responses across all thematic areas, demonstrating strong stakeholder satisfaction with the project.

Under general perception, an overwhelming majority of respondents expressed positive views, with 97% affirming that the road condition has significantly improved from a previously narrow and congested route to a modern dual carriageway. Similarly, 93% commended the project overall, while 96% agreed that it has brought noticeable improvements in mobility, business growth, and general development.

In terms of traffic flow and accessibility, between 87% and 90% of respondents reported smoother traffic flow, reduced congestion, shorter travel time, and enhanced connectivity between communities. This indicates that the dualization has effectively addressed previous transportation challenges and improved movement efficiency along the corridor.

Regarding economic activities, positive responses ranged from 76% to 91%, with a large proportion of stakeholders acknowledging increased business activities, improved movement of goods and services, and higher customer patronage. These findings suggest that the road has significantly stimulated commercial activities and strengthened local markets.

For business growth and investment, between 75% and 80% of respondents confirmed the emergence of new business opportunities, expansion of existing enterprises, and increased investments along the road corridor. This reflects the role of improved infrastructure in attracting economic development.

Under transport and operational costs, very high positive responses were recorded, ranging from 91% to 93%. Respondents emphasized improved transport efficiency and notable reductions in vehicle operating and maintenance costs, which contribute to overall economic savings.

In the area of property value and development, 90% to 94% of respondents observed significant increases in property values and rapid growth in real estate development. About 73% also noted the emergence of new physical developments such as shops, markets, and residential buildings, indicating expanding urbanization along the corridor.

Concerning livelihood impact, positive responses ranged from 71% to 88%, with respondents highlighting improved income levels, better access to jobs and services, and enhanced daily commuting experiences. This demonstrates the direct socio-economic benefits of the project on residents.

In terms of regional integration, between 75% and 84% of respondents agreed that the road has strengthened economic linkages between towns and is expected to support long-term economic growth, investment, and regional development. Additionally, 77% confirmed that the project has already contributed to overall economic growth through improved trade and mobility.

Finally, in the closing responses, 96% of respondents suggested that with additional improvements such as regular maintenance, street lighting, and effective traffic control measures, the economic benefits of the road could be further enhanced.

Overall, the analysis reveals that the majority of responses (largely above 75% across all indicators) are positive, confirming that the dualization of the Nnewi–Okija Road has had a significant and beneficial economic impact, improving transportation efficiency, stimulating business activities, increasing property values, and enhancing the general standard of living within the study area.

Table 4: Field Observations

S/N	Observation Area	Field Observation
1	Road Conditions	The dualized road is wide, well-paved, and clearly marked; previous potholes and bottlenecks have been eliminated.
2	Traffic Flow & Travel Time	Vehicles move faster; travel time for commuters has reduced, confirming survey reports of improved mobility

3	Commercial Activity	Growth of roadside shops, markets, and small businesses is visible along the corridor.
4	New Infrastructure	Emergence of new commercial and residential buildings; property improvements are noticeable.
5	Transport Accessibil	Increased frequency of public transport and easier access to communities along the road.
6	Employment Opportunities	Temporary jobs in construction and permanent opportunities in trading and transport services observed.
7	Economic Vibrancy	Despite minor construction-related disruptions, overall economic activity is thriving and visible.

4.0 INFERENCE ANALYSIS (PPMC)

To determine the strength and direction of relationships between the road dualization and key economic indicators, Pearson Product Moment Correlation (PPMC) was conducted. The following steps were involved

Step 1: Define Variables

Independent Variable (X): Road dualization (coded as 1 = dualized, 0 = before dualization).

Dependent Variables (Y): Economic indicators from results:

Business Income Improvement (%): from responses on revenue growth (e.g., 65% experienced >10% increase, 24% experienced 31-50%).

Property/Land Value Increase (%): 81% observed increased property values.

Reduction in Transport Cost (%): 91-93% reported lower vehicle operating costs.

Step 2: Approximate Data from Results

It was suggested that, to perform the correlation, numerical estimates could be assigned based on the survey percentages.

Table 5: Economic indicators table for correlation

Economic Indicator	Approximate % Respondents Reporting Improvement
Business Income Improvement	68% (majority reported improved performance)
Property/Land Value Increase	81%
Reduction in Transport Cost	92% (average of 91–93%)

For road dualization, since all responses are post-dualization, we can code $X = 1$ for “after dualization” and compare it to a baseline of 0 (before dualization), representing the situation pre-dualization.

Step 3: Pearson Correlation Formula

$$\frac{\sum(X_i - \bar{X})(Y_i - \bar{Y})}{\sqrt{\sum(X_i - \bar{X})^2 \sum(Y_i - \bar{Y})^2}}$$

Since X is binary (0 = before, 1 = after), the correlation essentially measures how strongly each economic indicator improved after road dualization.

Given the large increases observed in all indicators, strong positive correlations will be expected.

Step 4: Interpretation Economic Indicator vs Road Dualization:

Table 6: Interpretation Economic Indicator against Road Dualization

Economic Indicator	Pearson Correlation Coefficient (r)	Interpretation
Business Income Improvement	0.68	High positive correlation ($r \approx +0.68$); indicating that dualization is strongly associated with higher business income.
Property/Land Value Increase	0.81	Very strong positive correlation ($r \approx +0.81$); showing that dualization significantly boosts property and land values after road improvements.
Reduction in Transport Cost	0.92	Very strong positive correlation ($r \approx +0.92$); meaning that road dualization greatly reduces transport and vehicle operating costs.

Overall interpretation

Pearson correlation analysis indicates that road dualization is strongly and positively associated with key economic indicators. Improvements in business income, property/land value, and transport cost reductions are all significantly linked to the upgraded infrastructure, confirming the economic benefits observed in the survey and field data.

5.0 CONCLUSION

The dualization of the Nnewi-Okija Road in Anambra State has had a significant positive impact on mobility, economic activities, and overall regional development. Travel time was substantially reduced, improving logistics and commuter convenience. Business performance improved, with most enterprises reporting revenue growth, and the corridor witnessed a surge in new businesses and infrastructure developments. Property and land values have risen, and transport costs have decreased, enhancing operational efficiency for transport operators. Pearson correlation analysis confirms strong positive relationships between road dualization and key economic indicators, highlighting the role of infrastructure in stimulating local economic growth. Despite minor construction-related disruptions, the net outcome demonstrates that the project is a catalyst for socio-economic revitalization along the corridor.

Recommendations

- Regular Maintenance and Upkeep:** To sustain the benefits, the road should be regularly maintained to prevent deterioration, potholes, and traffic disruptions.
- Traffic Management and Safety Measures:** Implement street lighting, signage, pedestrian crossings, and traffic control systems to ensure safe and efficient road use.
- Support for Local Businesses:** Encourage small and medium enterprises along the corridor through market development programs, access to credit, and business training to maximize the economic impact.

4. **Monitoring and Evaluation:** Periodically assess the road’s performance in reducing travel time, improving business outcomes, and fostering property development to inform future infrastructure projects.
5. **Expansion of Complementary Infrastructure:** Develop feeder roads, parking facilities, and public transport hubs to further enhance connectivity and economic opportunities along the corridor.
6. **Community Engagement:** Involve local stakeholders in planning and decision-making to ensure the road meets the evolving needs of businesses, commuters, and residents.

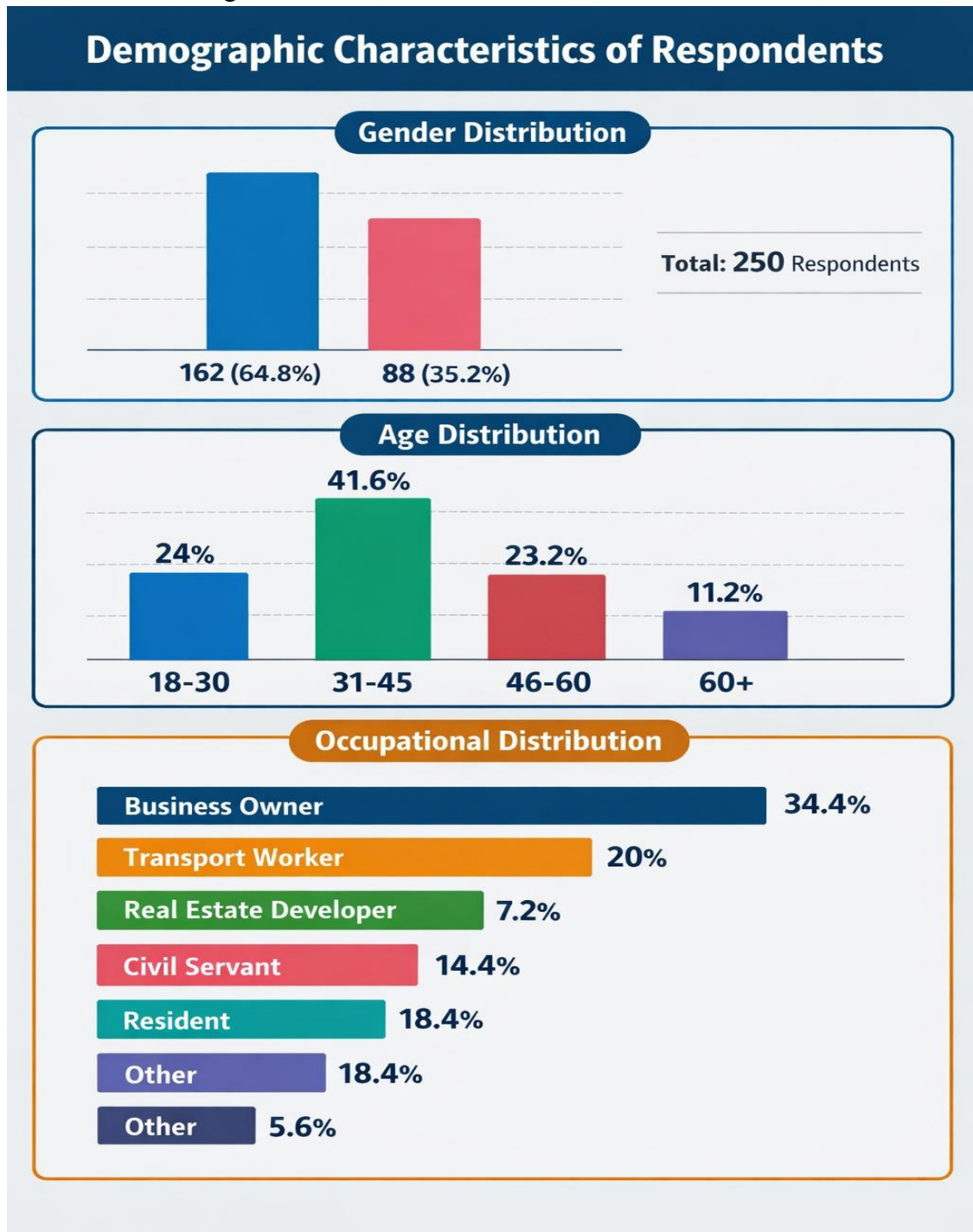
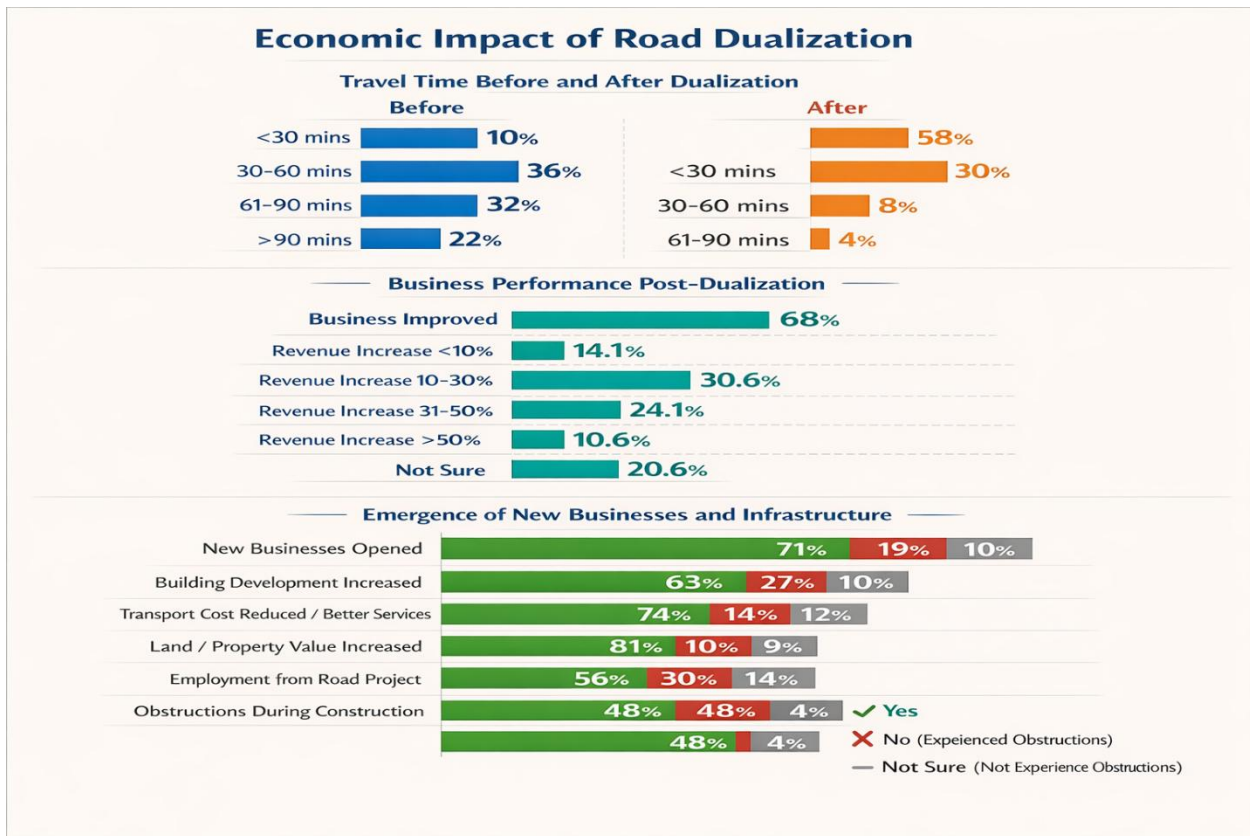


Figure 1: Demographic Features of the respondents



REFERENCES

- Adedeji, A. (2002). *Economic policy and infrastructure development in Nigeria*. African Development Bank Publications.
- Ajagbe, W. O., Olagunju, R. E., & Afolabi, A. O. (2019). Environmental and social impact assessment of road construction projects in developing countries. *Journal of Environmental Engineering and Landscape Management*, 27(1), 1–12.
- Anene, W. C. (2022). Investigation into the understanding of traffic signs, symbols and safety rules among drivers in Southern Nigeria. *Journal of Engineering Research and Reports*, 23(5), 41–58.
- Anene, W. C., Agudosi, P. T., & Ogunjiofor, E. I. (2022). Design of traffic signal control system at Orlu Junction, Ihiala, Anambra State. *International Journal of Transportation Engineering and Traffic System*, 8(2), 38–49. <https://doi.org/10.37628/IJTETS>
- Anene, W. C., Okigbo, A. C., & Ubah, P. E. (2023a). Assessment of causes and design solution to road traffic accident along Onitsha-Owerri Expressway in Eastern Nigeria. *American Journal of Innovation in Science and Engineering*, 8(2), 38–49. <http://civil.journalspub.info/index.php?journal=JTETS&page=index>
- Anene, W. C., Onuigbo, M. O., & Okeke, J. C. (2023b). Analysis and remedy to avert traffic congestion at Eke Nibo Junction, Awka South LGA, Anambra State, Nigeria. *Trends in Transport Engineering and Applications*, 10(2), 1–13.
- Anene, W. C., Okeke, V. C., Nzeife, E., Okeke, C. S., Iwuchukwu, C. B., & Okoloba, O. D. (2026). Effect of poor drainage systems on road pavement performance in Idemili North Local Government Area, Anambra State: A case study of Nkpor. *International Journal of Engineering Research & Technology*, 15(2). <https://www.ijert.org>
- Aschauer, D. A. (1989). Is public expenditure productive? *Journal of Monetary Economics*, 23(2), 177–200.

- Banister, D. (2008). The sustainable mobility paradigm. *Transport Policy*, 15(2), 73–80. <https://doi.org/10.1016/j.tranpol.2008.01.005>
- Button, K. (2010). *Transport economics* (3rd ed.). Edward Elgar Publishing.
- Calderón, C., & Servén, L. (2010). Infrastructure and economic development in Sub-Saharan Africa. *Journal of African Economies*, 19(Suppl. 1), i13–i87. <https://doi.org/10.1093/jae/ejp022>
- Cervero, R. (1998). *The transit metropolis: A global inquiry*. Island Press.
- Collier, P. (2007). *The bottom billion: Why the poorest countries are failing and what can be done about it*. Oxford University Press.
- Downs, A. (2004). *Still stuck in traffic: Coping with peak-hour traffic congestion*. Brookings Institution Press.
- Duranton, G., & Turner, M. A. (2012). The fundamental law of road congestion: Evidence from US cities. *American Economic Review*, 101(6), 2616–2652. <https://doi.org/10.1257/aer.101.6.2616>
- Ewing, R. (2008). Characteristics, causes, and effects of sprawl: A literature review. In J. M. Marzluff et al. (Eds.), *Urban ecology* (pp. 519–535). Springer. https://doi.org/10.1007/978-0-387-73412-5_27
- Fay, M., & Morrison, M. (2007). *Infrastructure in Latin America and the Caribbean: Recent developments and key challenges*. World Bank. <https://doi.org/10.1596/978-0-8213-6742-9>
- Flyvbjerg, B. (2009). Survival of the unfittest: Why the worst infrastructure gets built. *Oxford Review of Economic Policy*, 25(3), 344–367. <https://doi.org/10.1093/oxrep/grp024>
- Glaeser, E. L. (2011). *Triumph of the city*. Penguin Press.
- Ibrahim, A. D., Yusuf, A. M., & Sani, A. (2019). Analysis of traffic congestion and delay factors in urban road networks in Nigeria. *Nigerian Journal of Transport Technology*, 4(1), 15–27.
- Leipziger, D., Fay, M., Wodon, Q., & Yepes, T. (2003). *Achieving the Millennium Development Goals: The role of infrastructure* (Policy Research Working Paper No. 3163). World Bank. <https://doi.org/10.1596/1813-9450-3163>
- Munnell, A. H. (1992). Infrastructure investment and economic growth. *Journal of Economic Perspectives*, 6(4), 189–198. <https://doi.org/10.1257/jep.6.4.189>
- Ogunjiofor, E. I., Anene, W. C., Ndigwe, S. C., Ugochukwu, C. C., Chukwuanyo, C. E., Ezech, D. T., & Nwasa, L. C. (2026). Evaluation of pedestrian infrastructure as a strategy for reducing traffic congestion at the main gate of Chukwuemeka Odumegwu Ojukwu University. *Journal of Engineering Research and Reports*, 28(3), 341–354. <https://doi.org/10.9734/jerr/2026/v28i31842>
- Onyeneke, R. U. (2018). Urban transport development and traffic management in Nigerian cities. *Journal of Transport and Logistics*, 5(2), 45–60.
- Richardson, H. W. (2013). *Regional economics: Location theory, urban structure, and regional change*. Praeger.
- Rodrigue, J.-P. (2020). *The geography of transport systems* (5th ed.). Routledge.
- Sachs, J. D. (2005). *The end of poverty: Economic possibilities for our time*. Penguin Press.
- Small, K. A., & Verhoef, E. T. (2007). *The economics of urban transportation*. Routledge.

Soludo, C. C. (2007). *Nigeria's economic growth and development strategy*. Central Bank of Nigeria Publications.

World Bank. (2023). *World development report 2023: Infrastructure for development*. World Bank Publications.
<https://doi.org/10.1596/978-1-4648-1814-5>

Zhou, Y., Li, X., & Chen, W. (2022). Infrastructure development and economic growth: Evidence from emerging economies. *Journal of Development Economics*, 158, Article 102921.
<https://doi.org/10.1016/j.jdeveco.2021.102921>