

Research Article

Impact of Road Construction Delays on Public Well-Being in Minna, Niger State, Nigeria

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ABSTRACT

Transportation is a fundamental pillar of national development, yet in Nigeria, road projects are frequently hindered by construction delays caused by funding issues, poor management, and unexpected site conditions. This study assesses the multifaceted impact of these delays on public well-being in Minna, Niger State, Nigeria, focusing on the period between 2020 and 2025. Using a mixed-methods cross-sectional survey design and a sample of 384 respondents, the research investigates economic consequences, psychological effects, accessibility to services, and environmental health risks. The findings derived from regression analysis reveal that road construction delays are a powerful predictor of public well-being, with an R^2 of 0.771, explaining approximately 77.1% of the variability in well-being ($F = 333.027$; $p = 0.000$). Specifically, the study finds that delays increase transportation costs, reduce business productivity, and restrict access to essential services like healthcare and education. Furthermore, prolonged exposure to construction zones leads to physical health risks such as respiratory conditions (asthma and bronchitis) and psychological distress, including anxiety, fatigue, and mental strain. The study concludes that there is a significant gap in urban governance and stakeholder management, recommending stricter oversight, environmental mitigation strategies like water sprinkling, and the implementation of inclusive participatory planning to protect public health and well-being.

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1 Introduction

Transportation is a critical component of national development, influencing economic growth, access to services, social integration, and the overall quality of life (World Bank, 2023; Rodrigue, 2020). Efficient transportation systems enable the movement of goods and people, reduce travel time, and promote connectivity among communities. In both urban and rural settings, road infrastructure plays a significant role in transportation networks. Roads facilitate not only the daily commute of individuals but also the delivery of essential goods and services, emergency response, healthcare access, and education (Ajanlekoko et al., 2022).

In emerging countries like Nigeria, transportation infrastructure has long been plagued by inefficiencies, limited investment, and poor planning (Adeleke et al., 2020). Roads remain the most widely used means of transport, particularly in cities like Minna, where other modes such as rail or air travel are limited in reach or affordability (Agunbiade et al., 2021). Consequently, there is increasing demand for road construction and expansion projects to meet the growing needs of urbanization, industrial activities, and population growth. However, the reality of project execution often deviates significantly from initial plans. One major issue that consistently hinders the success of road infrastructure development in Nigeria is the occurrence of construction delays (Oke et al., 2020).

Construction delay is a global challenge in the construction industry and is typically associated with cost and time overruns. These delays adversely impact project sponsors, clients, and project teams, often resulting in disputes, financial strain, litigation, and renegotiations (Ameh et al., 2021). Delays are commonly linked to poor project management, unexpected site conditions, funding issues, and administrative inefficiencies (Aliyu et al., 2019). Projects are also vulnerable to delays due to the complexity of managing multiple stakeholders and the unpredictability of external factors like weather and regulatory changes.

In the context of road construction, delays can have significant ripple effects on surrounding communities and the broader economy. Projects intended to ease transportation and improve safety may become sources of disruption and public frustration due to prolonged exposure to construction-related inconveniences (Oladokun et al., 2023). While discussions on road project delays often focus on their economic consequences, such as budget overruns and contract disputes, there is a growing recognition of their impact on public health.

Prolonged road construction exposes individuals to health risks beyond traffic disruptions. The presence of dust, noise pollution, and unsecured construction zones can lead to respiratory conditions like asthma and bronchitis, hearing impairments, and physical injuries (Okonkwo & Edache, 2020; WHO, 2021). Moreover,

persistent construction activity may contribute to psychological distress, including anxiety, fatigue, cardiovascular strain, and depression among affected residents and commuters (Adetunji et al., 2022). These health consequences are often underestimated in planning and evaluation frameworks, even though they critically affect public well-being and social stability.

In Minna, the capital of Niger State, several road construction projects have been launched to improve urban mobility. However, many of these projects have faced significant delays (Niger State Ministry of Works, 2023). Roads are frequently left incomplete, with materials and equipment obstructing walkways and commercial spaces. This has led to widespread disruptions in daily activities and growing concerns about health implications among the city's residents. Unlike larger cities, Minna has limited healthcare infrastructure, making it difficult to address the cumulative health risks of such prolonged construction exposure.

Furthermore, the informal and unplanned nature of many neighborhoods in Minna increases their vulnerability to these disruptions (UN-Habitat, 2022). Children playing near active construction sites, market traders operating next to dusty roads, and schoolchildren walking amid heavy machinery are common sights. These challenges highlight the need for a broader and deeper understanding of how road construction delays affect public health, beyond conventional traffic and economic concerns.

This study, therefore, seeks to examine the physical and psychological health impacts, such as respiratory problems, fatigue, as well as stress and anxiety, of road construction delays on residents and road users in Minna. It aims to identify coping strategies, public perceptions, and potential policy responses. By shifting the focus away from congestion alone, this research provides insights into the often-overlooked human health dimensions of delayed infrastructure development.

1.1 Theoretical Framework

This study is anchored in Systems Theory and Public Good Theory, which provide a comprehensive framework for understanding the relationship between road construction delays and public well-being. While Systems Theory explains how transportation disruptions affect interconnected urban systems, Public Good Theory highlights the role of government in the provision and efficient management of infrastructure.

Together, these theories offer a strong basis for analysing the economic, psychological, and environmental impacts of road construction delays in Minna, Niger State.

1.1.1 General Systems Theory (GST)

Systems Theory, originally developed by Ludwig von Bertalanffy (1968), provides a holistic framework for understanding complex phenomena as interconnected and interdependent components within a unified whole. Rather than examining elements in isolation, Systems Theory emphasizes that changes or disruptions in one part of a system inevitably produce ripple effects across other components. In the context of urban environments, infrastructure systems such as transportation, healthcare, education, and economic activities are tightly interlinked and function as subsystems of a broader socio-economic system.

Applied to road infrastructure, Systems Theory suggests that transportation networks serve as a foundational subsystem that supports mobility, accessibility, and economic exchange. When road construction projects are delayed, this disruption does not remain confined to the transport sector alone; rather, it cascades across multiple urban systems. For instance, restricted mobility due to incomplete roads can limit access to healthcare facilities, delay emergency response times, and reduce attendance at schools and workplaces. Similarly, economic systems are affected as traders, transport operators, and small businesses experience reduced patronage and increased operational costs.

In Minna, Niger State, where alternative transport modes such as rail and air are limited, the road network represents a critical backbone of urban functioning. Delays in major road projects such as the Minna-Bida Road or urban bypasses create systemic inefficiencies that disrupt daily life. These disruptions manifest in increased travel time, congestion, environmental pollution, and reduced productivity, all of which directly and indirectly influence public well-being.

Furthermore, Systems Theory helps explain the multidimensional nature of public well-being as used in this study. The dependent variable, public well-being, is not a single isolated outcome but a composite of economic stability, psychological health, environmental safety, and accessibility to services. These dimensions interact dynamically; for example, increased transport costs (economic) may lead to stress (psychological), while exposure to dust (environmental) may result in respiratory illness (health). Thus, the theory provides a robust framework for understanding how road construction delays act as a systemic disturbance that propagates across multiple domains of well-being.

Empirically, the strong statistical association observed in this study ($R^2 = 0.771$) aligns with the assumptions of Systems Theory, demonstrating that disruptions in the transportation subsystem are significantly associated with variations in broader public well-being outcomes. Therefore, Systems Theory not only underpins the

conceptual framework of this research but also justifies the integrated analysis of economic, psychological, and environmental impacts.

1.1.2 Public Goods Theory (PGT)

Public Goods Theory, advanced by scholars such as Joseph Stiglitz (2021), provides a critical lens for understanding the provision and management of infrastructure such as roads. Public goods are typically defined by two key characteristics: non-excludability (individuals cannot be prevented from using them) and non-rivalry (one person's use does not significantly reduce availability to others). Road infrastructure fits this definition, as it is intended to be accessible to all members of society and serves as a shared resource that facilitates mobility, economic activity, and social interaction.

Within this framework, governments bear the primary responsibility for the provision, maintenance, and timely delivery of road infrastructure. Efficient road networks generate widespread social benefits, including reduced transport costs, improved access to essential services, and enhanced economic productivity. However, when road construction projects are delayed, the expected benefits of these public goods are significantly diminished, leading to what can be described as a "public goods failure."

In the context of Minna, delays in road construction undermine the accessibility and functionality of these shared resources. Although roads are designed to be universally accessible, prolonged construction effectively restricts access, particularly for vulnerable populations such as low-income earners, schoolchildren, and the elderly. This creates a paradox where a non-excludable good becomes temporarily exclusionary due to poor implementation and governance inefficiencies.

Moreover, Public Goods Theory highlights issues of accountability and governance. Since road projects are funded through public resources like taxes, delays raise critical concerns about the efficiency of public expenditure, contractor performance, and institutional oversight. The findings of this study, particularly the significant association between delays and reduced public well-being, underscore the consequences of inadequate management of public goods. Increased transportation costs, reduced business activity, and limited access to healthcare and education reflect a failure to deliver the full social value of infrastructure investments.

The theory also provides a foundation for the policy recommendations proposed in this study. Measures such as stricter enforcement of contract timelines, improved project monitoring, environmental mitigation strategies, and participatory planning align with the

principles of efficient public goods provision. By ensuring that road infrastructure is delivered on time and managed effectively, government agencies can maximize their benefits and enhance overall public well-being.

1.2 Conceptual Framework

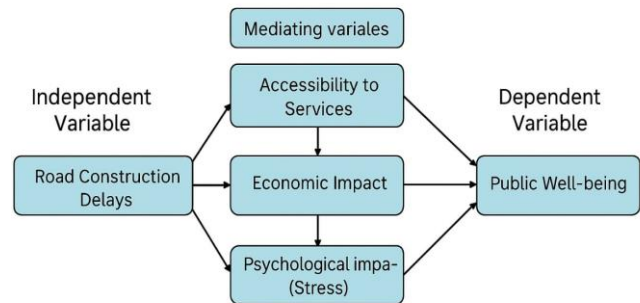


Figure 1: Conceptual framework

Figure 1 shows the conceptual framework of the study, highlighting the relationship between road construction delays (independent variable) and public well-being (dependent variable). Public well-being is examined through economic, psychological, and environmental dimensions. The framework guides the empirical analysis and links directly to the theoretical foundations discussed above.

2 Materials and Methods

2.1 Study Area

Minna is the capital city of Niger State, located in the North-Central geopolitical zone of Nigeria. It lies approximately between latitudes 9°31' and 9°40' N and longitudes 6°29' and 6°36' E (Figure 2). The city covers a land area of about 88 square kilometres and is situated at an elevation of 260 metres above sea level. National Population Commission (2006). Minna is strategically positioned along the major rail and road networks connecting northern and southern Nigeria, making it a critical transport and administrative hub.

Minna experiences a tropical savannah climate characterised by distinct wet and dry seasons. The rainy season typically spans from April to October, with peak rainfall occurring between July and September. The dry season, which includes the Harmattan period, lasts from November to March. Annual rainfall ranges between 1,100 mm and 1,300 mm, while average daily temperatures vary between 22°C and 35°C (Adebayo, 2020).

According to estimates, Minna has a population of over 6,000,000 residents and continues to grow due to

urbanisation and rural-to-urban migration (National Population Commission, 2020). The population is culturally diverse, consisting of major ethnic groups such as the Gwari (Gbagyi), Hausa, Nupe, Yoruba, and Igbo. Islam and Christianity are the dominant religions in the city (Ogunyemi et al., 2022).

Minna is both a political and economic centre. It hosts the Niger State Government Secretariat, local government offices, and several private and public institutions. The city's economy is driven by commerce, civil service employment, agriculture, and small-scale manufacturing. Informal economic activities such as petty trading and transport services are also prominent. Minna is home to important markets like Kure, Gwari, and Bosso Market, which serve as major points for goods distribution within the state (Amos & Okunola, 2021).

However, the city faces challenges such as poor road conditions, inadequate drainage systems, and insufficient waste management services. Ongoing and delayed road construction projects within Minna have affected mobility, access to services, health, and local economic activities, forming the basis of this study.

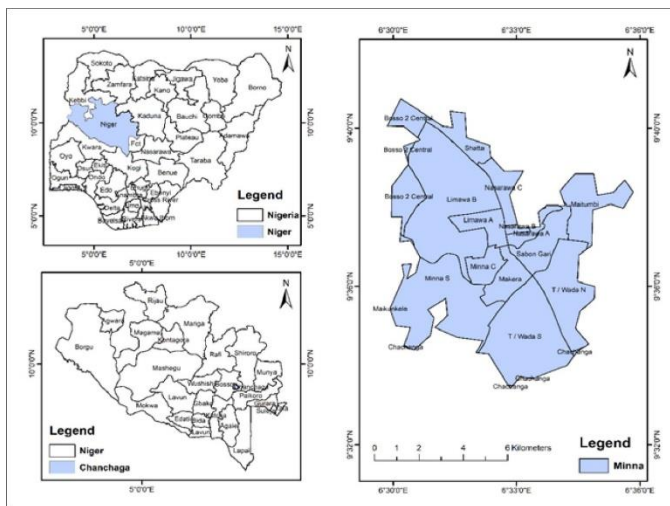


Figure 2: Study Area

2.2 Research Design

The present study applied a quantitative cross-sectional survey design to investigate how delays in road construction affect public well-being. According to Creswell & Creswell (2023), a descriptive survey provides one of the best designs for collecting measurable data from a specified population in order to describe trends, perceptions, and relationships among variables.

2.3 Types and sources of data

This study utilized primary data as the main source of information. Primary data were collected directly from respondents through the administration of structured questionnaires. The data captured respondents'

perceptions of road construction delays and their effects on public well-being, including economic impacts, psychological stress, accessibility to services, and environmental health risks.

The respondents included road users such as commuters and drivers, residents living near construction sites, small business owners operating along affected roads, and other stakeholders within Minna, Niger State.

In addition to primary data, limited secondary data were consulted to support the study. These included published literature, government reports, and previous research studies related to road infrastructure, construction delays, and public well-being. These sources were used mainly to provide background information and support the discussion of findings.

2.4 Population and Sample Size

The target population includes Road users such as commuters, drivers, and transport workers; residents living near affected construction zones; small business owners along the construction corridors; and Relevant government agencies, such as the Niger State Ministry of Works and Transport.

The sample size for this study was determined using the Cochran formula for sample size calculation, which is suitable for large populations. The formula ensures that the sample is statistically representative of the population at a 95% confidence level and a 5% margin of error.

$$n_0 = (Z^2 \cdot p \cdot (1 - p)) / e^2$$

Where:

n_0 = required sample size

Z = Z-score (1.96 for 95% confidence level)

p = estimated proportion of the population (0.5 for maximum variability)

e = margin of error (0.05)

Substituting the values:

$$n_0 = (1.96^2 \times 0.5 \times (1 - 0.5)) / (0.05)^2$$

$$= (3.8416 \times 0.25) / 0.0025$$

$$= 0.9604 / 0.0025$$

$$= 384.16$$

2.5 Sampling Techniques

A purposive sampling technique was employed to select respondents for this study. This method was chosen because it allows the researcher to target individuals who are most affected by or knowledgeable about road construction delays. The respondents included

commuters, drivers, residents living near active construction sites, and small business owners operating along the affected road corridors. By focusing on these specific groups, the study ensures that the data collected is relevant to understanding the impact of road construction delays on public well-being in Minna.

2.6 Method of data collection

The data were collected using a structured questionnaire administered to respondents in selected areas affected by road construction delays. The questionnaire included both closed-ended questions based on a Likert scale and demographic questions.

2.7 Operationalization of Variables

This study examined the impact of road construction delays on public well-being in Minna, Niger State. The independent variable, Road Construction Delays (RCD), and the dependent variable, Public Well-Being (PWB), were clearly defined and measured to ensure accuracy and reliability in the analysis.

Independent Variable: Road Construction Delays (RCD)

Road construction delays were measured based on respondents' perceptions of the severity and effects of ongoing road projects in their area between 2020 and 2025. The focus is on how these delays are experienced by public, rather than the causes behind them. Specific aspects measured include:

- i. **Perceived duration of delays:** Whether projects are seen as taking longer than expected.
- ii. **Impact on mobility:** How the delays affect travel times and access to locations.
- iii. **Disruption to daily life:** Effect on commuting, business operations, and access to services.

Respondents rated these aspects on a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree). A composite score was calculated to represent the overall impact of road construction delays as perceived by the participants.

Dependent Variable: Public Well-Being (PWB)

Public well-Being was operationalized as a composite measure encompassing economic, psychological, access to services, and environmental health dimensions, focusing on how it is affected by road construction delays. Specific indicators include:

- i. **Economic well-being:** Increased transportation costs, reduced business productivity, and limited access to markets and essential services
- ii. **Psychological well-being:** Stress, anxiety, fatigue, and mental strain due to navigating delayed roads.

- iii. **Environmental/ Health well-being:** Exposure to dust and noise pollution, and incidence of respiratory conditions such as asthma and bronchitis.

All indicators were assessed using 5-point Likert scale items (1= strongly disagree to 5= Strongly Agree). The responses were combined to form an overall public well-being score, used as the dependent variable in the regression analysis.

However, by focusing on perceived impacts of delays, this operationalization aligns with the study's objective. The composite RCD score serves as the predictor, while the PWB composite score serves as the outcome, providing a clear and measurable basis for examining the relationship between road construction delays and public well-being.

2.8 Method of data analysis

The data collected for this study were analysed using the Statistical Package for the Social Sciences (SPSS) version 25. Both descriptive and inferential statistical techniques were employed to achieve the study objectives.

Descriptive statistics, including frequency distribution, percentages, means, and standard deviation, were used to summarize respondents' demographic characteristics and assess general perceptions regarding road construction delays and public well-being. These statistics provided a clear understanding of the sample structure and response patterns.

3 Results

3.1 Questionnaire administration

The number of questionnaires distributed to the respondents is based on the sample size determined in section 2.4 above. Therefore, 384 questionnaires were distributed, and out of these, 298 (99.6%) questionnaires were successfully retrieved, representing the response rate (Table 1). Out of the retrieved questionnaires, 292 (76%) were found to be properly completed and suitable for analysis, while 6 were excluded due to incomplete or inconsistent responses.

Table 1: Response Rates

Sample Size	Collected	Used
384	298(99.6%)	292 (76%)

3.2 Demographic Information of Respondents

The demographic information was sought from the participants to enable contextual analysis based on road construction delays and public well-being (Table 2).

Table 2: Demographic Profile of Respondents

Variable		Frequency	Percent
Gender	Male	153	52.4
	Female	139	47.6
Age	18–25	95	32.5
	26–35	52	17.8
	36–45	62	21.2
	46–55	55	18.8
	56+	28	9.6
Highest Educational Qualification	Primary	14	4.8
	Secondary	79	27.1
	HND/NCE	94	32.2
	Degree	69	23.6
	Postgraduate	36	12.3
Employment	Student	110	37.7
	Civil Servant	46	15.8
	Business Owner	64	21.9
	Private Sector Employee	35	12.0
	Self-employed	37	12.7

Table 2 provides a comprehensive overview of the survey participants. Regarding gender, the sample is relatively balanced but leans slightly towards a male majority, with 52.4% (153) identifying as male and 47.6% (139) as female. This near-parity suggests that the survey results are likely to reflect perspectives from both genders without a significant biological or social bias toward one group.

In terms of age distribution, the respondent base is notably young. The largest single demographic is the 18–25 age bracket, which accounts for 32.5% of the total.

Table 3: Effects of the Road Construction Delays on Public Well-Being

Model	R	R Square	Adjusted R-Square	Std. Error of the Estimate	Mean Square	F	Sig.
1	.878 ^a	.771	.769	.37496	46.822	333.027	.000
					.141		

a. Predictors: (Constant), Road Construction Delays

b. Dependent Variable: Public Well-Being

As can be seen from Table 2 above, the overall regression model is a very strong and significant predictor for Public Well-Being. The R-Squared value is 0.771; this means that the overall regression model explains approximately 77.1% of the variability among the Road Construction Delays predicted by the overall regression model. The overall model is a very good fit with the Adj. R-Squared at 0.769 and is significant: $F = 333.027$; $p = 0.000$.

When combined with the 26–35 age group (17.8%), over half of the participants are 35 years old or younger. Conversely, the participation rate steadily declines in the older brackets, with those aged 56 and above representing the smallest portion of the sample at just 9.6%. This suggests the study's findings may be most applicable to a younger, more active demographic.

The educational profile of the participants indicates a high level of literacy and formal training. The most common qualification held is an HND/NCE (32.2%), followed closely by those with a secondary education (27.1%) and university degrees (23.6%). High-level academic attainment is also present, with 12.3% of the sample possessing postgraduate qualifications. Only a very small fraction, 4.8%, reported having only a primary education, reflecting a sample that is largely composed of individuals with tertiary-level exposure.

The employment data reveals a strong presence of the academic and entrepreneurial sectors. Students comprise the largest occupational group at 37.7%, which aligns with the high frequency of younger respondents. This is followed by Business Owners at 21.9%, indicating a significant entrepreneurial spirit among the participants. The remaining respondents are distributed among Civil Servants (15.8%), the Self-employed (12.7%), and Private Sector Employees (12.0%), showing a diverse range of professional backgrounds.

3.3 Influence of road construction delays on public well-being

The effects of the Road Construction Delays on Public Well-Being were tested using regression analysis. The findings can be observed in Table 3.

4 Discussion of Findings

The regression analysis results indicate that road construction delays are a strong and statistically significant predictor of public well-being in Minna. With an R-Squared value of 0.771, the model demonstrates that approximately 77.1% of the variability in public well-being is explained by construction delays. This finding is supported by a highly significant F-statistic ($F = 333.027$; $p = 0.000$), suggesting a strong association between construction delays and public well-being.

However, given the cross-sectional nature of the study, these findings indicate relationships rather than causality. The disruptions caused by infrastructure projects have a profound and measurable negative impact on the quality of life for the city's residents.

These statistical results validate the study's hypothesis that the deviation from initial project execution plans creates a significant ripple effect on the surrounding community. This pattern of interconnected impacts can be explained using System Theory, which emphasizes the interdependence of components within a broader socio-economic system. The findings suggest that disruptions in the transportation subsystem are associated with cascading effects on other sectors such as economic activities, healthcare access, and social well-being, reinforcing the notion that infrastructure delays extend beyond mobility challenges to affect the overall functioning of urban systems.

The economic dimension of these findings reveals that delays are perceived as a major barrier to local prosperity and daily survival. For many residents and businesses in Minna, the lack of timely road completion is associated with increased transportation costs and a direct loss of income. Business owners and traders, particularly those situated along construction routes, suffer from reduced customer access and lower patronage, which threatens their long-term economic stability. Furthermore, the resulting traffic congestion and route diversions are linked with restricted access to essential services such as healthcare, markets, and education. This observation aligns with Public Goods Theory, which posits that infrastructure such as roads should be efficiently provided to ensure equitable access and societal benefit. The reduced accessibility and increased costs associated with construction delays indicate inefficiencies in the provision of this public good, thereby limiting its intended benefits to the population, placing a disproportionate burden on vulnerable groups like the elderly and school children.

Beyond economics, the discussion must highlight the severe health and psychological toll identified in the research. Prolonged exposure to active construction zones subjects residents to environmental hazards, including dust and noise pollution, which are associated with respiratory conditions like asthma and bronchitis. Psychologically, the constant state of uncertainty, combined with the stress of navigating poor road conditions, triggers high levels of frustration, anxiety, fatigue, and mental strain. This cumulative stress is exacerbated by the fact that Minna has limited healthcare infrastructure to address these emerging health risks. Ultimately, the findings underscore a significant gap in urban governance and stakeholder management.

While government agencies and contractors possess high decision-making influence, the primary stakeholders, the residents and small-scale traders, bear the heaviest burden while possessing the least influence over project timelines. The obstruction of walkways and commercial spaces by abandoned materials reflects a lack of human-centred planning. These results call for a policy shift toward participatory planning and more aggressive mitigation strategies to protect public well-being during essential infrastructure development.

Overall, the findings of this study are consistent with both System Theory and Public Goods Theory, demonstrating that road construction delays are associated with interconnected socio-economic and health outcomes, while also reflecting inefficiencies in the provision of essential public infrastructure.

5 Conclusion

This study assessed the impact of road construction delays on public well-being in Minna, Niger State, Nigeria, using a cross-sectional survey design. The findings reveal that road construction delays are significantly associated with multiple dimensions of public well-being, including economic stability, accessibility to essential services, psychological health, and environmental conditions. The regression analysis indicated a strong model fit, explaining a substantial proportion of variation in public well-being, thereby confirming a significant relationship between the variables examined.

The study further demonstrates that these findings are consistent with Systems Theory, which explains how disruptions in transportation infrastructure can produce cascading effects across interconnected social and economic systems. In addition, Public Goods Theory is supported by the results, as delays reflect inefficiencies in the provision of essential infrastructure intended to serve the public equitably.

Overall, the study concludes that road construction delays represent a significant urban challenge with wide-ranging implications for residents' quality of life. While causality cannot be inferred due to the cross-sectional design, the strong associations identified highlight the need for improved project management, timely delivery of infrastructure, and inclusive planning strategies to safeguard public well-being in urban areas.

Based on the study's findings regarding the significant impact of construction delays on public well-being, the following recommendations are proposed:

- i. The Niger State Ministry of Works and Infrastructure should implement stricter oversight and enforce penalty clauses for contractors who fail to meet deadlines to minimize prolonged economic and social disruptions.

- ii. Construction contractors should adopt environmental mitigation strategies, such as regular water sprinkling and proper site management, and dust control mechanisms to reduce the incidence of respiratory conditions like asthma and bronchitis among residents.
- iii. Regulatory and enforcement agencies (including urban development authorities) should ensure that construction materials and equipment do not obstruct walkways, market spaces, or school routes to protect vulnerable groups like children and traders.
- iv. Government health agencies should establish localized monitoring in construction hotspots to address the physical and psychological health risks, including anxiety and cardiovascular strain, caused by prolonged exposure to noise and dust.
- v. Urban planners should facilitate participatory planning and inclusive communication strategies that prioritize the needs of marginalized groups who bear the highest burden of construction delays.

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