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IMPACTS OF DELAYS IN PUBLIC INFRASTRUCTURE DEVELOPMENT ON ECONOMIC GROWTH IN ANAMBRA STATE, NIGERIA

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Abstract

Infrastructure constitutes a fundamental platform for economic production, investment, employment and social welfare. However, the economic value of infrastructure investment depends substantially on timely and effective project delivery. This study evaluates the impacts of delays in public infrastructure development (roads, public buildings and utilities) on economic growth in Anambra State, Nigeria. A descriptive survey research design was adopted. The study population comprised 475 stakeholders drawn from government ministries and construction professions. Using Yamane's formula and a combination of purposive and stratified random sampling, 217 questionnaires were administered; 163 valid responses were retrieved (response rate = 75.1%) and analysed. Data were analysed using frequencies, percentages, mean scores, Relative Importance Index (RII) and Pearson Product Moment Correlation. Respondents strongly associated infrastructure development with investment attraction (RII = 0.89), economic growth (0.86), economic expansion (0.85) and GDP contribution (0.82). Government policy and institutional performance were assessed only moderately, with policy challenges ranking highest (0.74) and procurement transparency lowest (0.61). Inadequate funding (0.85), bureaucracy (0.84), political interference (0.82), community issues (0.78) and contractor-related issues (0.77) were identified as the major causes of delay. Delays were associated with negative economic impact (0.80), reduced investment (0.79), reduced employment (0.79) and adverse effects on business activities (0.77). Technology adoption (0.92), institutional strengthening (0.88), increased funding (0.87), policy reform (0.85) and stakeholder engagement (0.84) emerged as the leading mitigation measures perceived by respondents. Pearson correlation yielded $r = 0.820$, $p < .001$, indicating a strong positive association between the severity of infrastructure delays and the severity of perceived adverse economic impacts; the null hypothesis was therefore rejected. The study concludes that timely public infrastructure delivery is an important condition for realising the economic benefits of public investment in Anambra State and recommends integrated technological, financial, institutional and stakeholder-based reforms. Findings are based on stakeholder perceptions rather than direct macroeconomic measurement.

Keywords: public infrastructure; construction delay; project delivery; economic growth; infrastructure investment; Anambra State; construction management

1. INTRODUCTION

Infrastructural development occupies a central position in the process of economic transformation because productive activity depends on the availability, quality and reliability of physical and institutional systems (African Development Bank, 2024; World Bank, 2022). Roads, bridges, power, water supply, communication systems, public buildings and related facilities support the movement of people and goods,

reduce transaction costs, facilitate access to markets and create conditions for investment (World Bank, 2022; Calderón & Servén, 2014). In developing economies, infrastructure investment is therefore expected to generate wider economic effects through productivity improvement, employment creation, capital formation and improved living standards (African Development Bank, 2024; Azolibe & Okonkwo, 2020). The timely delivery of such infrastructure is as important as the investment itself.

The construction and delivery of public infrastructure, however, are rarely linear processes. They involve planning, design, budgeting, procurement, contract administration, construction, supervision, monitoring and commissioning. Weaknesses at any stage may result in schedule overruns, cost escalation, disputes, scope changes or project abandonment. The literature identifies financial constraints, poor planning, bureaucratic bottlenecks, political interference, procurement difficulties, inflation, contractor inefficiency and community-related challenges among the recurring sources of delay in Nigeria (Aghimien et al., 2020; Alwashi et al., 2024; Sanni-Anibire et al., 2020). Such delays reduce the period during which infrastructure can generate its intended economic and social benefits (Akinradewo et al., 2021; Aghimien et al., 2021).

The problem is particularly relevant to Anambra State, an economically active state in southeastern Nigeria with extensive commercial activity, urban growth and a strong presence of small and medium-scale enterprises. Public investment has been directed toward roads, public buildings, drainage, utilities and other capital projects (Anambra State Government, 2024a; Voice of Nigeria, 2024a). Nevertheless, implementation gaps persist between budgetary allocations and actual expenditure. The Anambra State Medium-Term Expenditure Framework and budget performance information show substantial increases in capital allocations alongside fluctuations in implementation performance (Anambra State Government, 2024a; Anambra State Government, 2024b). This provides an important policy context for examining whether increased spending is translated into timely infrastructure delivery.

The economic consequences of delay extend beyond the construction site. A delayed road can prolong travel time and raise logistics costs; delayed public facilities can constrain service delivery; delayed utilities can reduce business productivity; and prolonged project execution can tie up public resources while postponing employment and investment opportunities. The issue is consequently not only one of project management but also of economic performance and public value (Afolayan et al., 2023; Akinradewo et al., 2021; Flyvbjerg et al., 2003).

1.1 Statement of the Research Problem

Although infrastructure is widely accepted as a driver of economic growth, the benefits of infrastructure investment are diminished when projects are delivered late (Aghimien et al., 2021; Akinradewo et al., 2021). Existing Nigerian studies have extensively considered the causes of construction delays (Aghimien et al., 2020; Alwashi et al., 2024; Ismaila et al., 2022; Ogunde et al., 2017), yet limited empirical evidence directly connects infrastructure delivery delays with economic growth at the sub-national level, particularly in Anambra State. Much of the existing evidence is descriptive or cross-sectional and often concentrates on individual project categories rather than the broader

relationship between infrastructure delay and economic performance.

The logical chain is clear: infrastructure investment is expected to generate growth, but delayed delivery postpones service benefits, imposes opportunity costs, and ultimately reduces economic performance. Policy decisions therefore require evidence not only on how infrastructure should be financed but also on whether institutional and project-delivery systems allow infrastructure investment to produce benefits within a reasonable time frame. The absence of focused, state-specific evidence on this relationship in Anambra State constitutes the central research problem addressed by this study.

1.2 Aim of the Study

The aim of this study is to evaluate the impacts of delays in public infrastructure development on economic growth in Anambra State, Nigeria.

1.3 Objectives of the Study

The specific objectives are to:

1. Examine the role of public infrastructural development in the growth of Anambra State.
2. Examine the relationship between public infrastructural development and economic growth in Anambra State.
3. Evaluate the impact of delays in public infrastructural development on economic growth in Anambra State.
4. Identify the major causes of delays in public infrastructure development in Anambra State.
5. Provide measures for reducing delays in public infrastructure development in Anambra State.

1.4 Research Questions

The study was guided by the following research questions:

1. What is the role of public infrastructural development in the growth of Anambra State?
2. What is the relationship between public infrastructural development and economic growth in Anambra State?
3. What is the impact of delays in public infrastructural development on economic growth in Anambra State?
4. What are the major causes of delays in public infrastructure development in Anambra State?
5. What measures can reduce delays in public infrastructure development in Anambra State?

1.5Hypothesis

The following null hypothesis was tested at the 0.05 level of significance:

H_0: There is no significant association between delay in public infrastructural development and economic growth (perceived economic performance) in Anambra State.

Pearson Product Moment Correlation was selected because the study examined the linear association between two continuous composite variables derived from Likert-scale responses. The hypothesis corresponds directly to Objective 3 and Research Question 3.

2. LITERATURE REVIEW

2.1Infrastructure Development and Economic Growth

Infrastructure development can be understood as the provision, expansion, upgrading and maintenance of foundational systems that support economic and social activity. The reviewed Nigerian literature distinguishes between hard infrastructure (transport networks, energy systems, water facilities and buildings) and soft infrastructure (institutional, regulatory and administrative systems that enable

physical assets to function effectively). This broader view is important because physical infrastructure cannot deliver its full value where governance arrangements are weak (Alwashi et al., 2024; Azolibe & Okonkwo, 2020).

The economic role of infrastructure operates through several mechanisms. Transport infrastructure improves market access and reduces movement costs; reliable energy supports production; water and sanitation improve health and productivity; communications infrastructure reduces information barriers; and public buildings support education, healthcare and administration. Infrastructure can also crowd in private investment by reducing the costs and uncertainties faced by firms (Calderón & Servén, 2014; African Development Bank, 2024; World Bank, 2022).

2.2Economic Development and Infrastructure Outcomes

Economic development is broader than a rise in aggregate output. It includes employment, productivity, investment, accessibility, improvements in living standards and the capacity of institutions to provide public services (Todaro & Smith, 2020). Infrastructure contributes to these outcomes by creating the physical environment in which firms and households operate. Conversely, infrastructure deficiencies and delayed delivery can weaken productivity and postpone the realisation of public benefits (Alwashi et al., 2024; Akinradewo et al., 2021). The distinction between infrastructure provision and timely infrastructure provision is therefore central. A project that eventually becomes operational may still have imposed substantial opportunity costs if its completion is significantly delayed. Timeliness is consequently a component of infrastructure effectiveness rather than merely a contractual performance indicator (Aghimien et al., 2021; Flyvbjerg et al., 2003).

2.3Project Delay in Construction

Project delay refers to failure to complete planned work within the stipulated contractual period. The literature classifies delays into excusable, non-excusable, compensable and concurrent categories. Excusable delays arise from events beyond the reasonable control of project parties; non-excusable delays are attributable to contractor-related failures; compensable delays arise from employer actions; and concurrent delays occur when overlapping causes involve more than one party. In public infrastructure, these categories may interact with broader institutional and economic conditions, making responsibility difficult to isolate (Alwashi et al., 2024; Unegbu et al., 2024; Sanni-Anibire et al., 2020; Aghimien et al., 2020).

2.4Theoretical Review

2.4.1 Endogenous Growth Theory (Primary Theoretical Framework)

Endogenous Growth Theory provides the primary theoretical foundation for this study. The theory emphasises internal drivers of growth, including capital formation, human capital, innovation and productive public investment (Barro, 1990; Lucas, 1988; Romer, 1986). Public infrastructure complements private capital and labour by improving the conditions under which productive activities occur. Roads, energy, communications and other systems can therefore raise productivity and expand the effective capacity of an economy (African Development Bank, 2024; Calderón & Servén, 2014). Within this

framework, delay in infrastructure delivery is interpreted as a postponement of productive public capital. Where infrastructure is incomplete or unavailable, firms may face higher operating costs, weaker market access and reduced incentives to invest. The expected growth effect of public expenditure is therefore weakened when projects do not become operational within their planned schedules (Afolayan et al., 2023; Akinradewo et al., 2021).

2.4.2 Project Management Theory

Project Management Theory emphasises the coordinated management of time, cost, scope and quality. Infrastructure projects require realistic scheduling, resource allocation, risk management, communication, monitoring and control (Kerzner, 2017; Afolayan et al., 2023). Delays can indicate failures in one or more of these functions. Extended project duration increases exposure to inflation, labour costs, equipment costs and financing charges, while delayed completion postpones the benefits that the project was designed to deliver (Aghimien et al., 2020; Ajayi & Chinda, 2022). This perspective links construction management directly to economic outcomes: effective project management protects public value by reducing avoidable expenditure and enabling infrastructure services to become available when they are needed.

2.4.3 Systems Theory

Systems Theory views infrastructure delivery as an interconnected system involving technical, financial, institutional, environmental and social subsystems. A disruption in one subsystem can generate consequences in others (Bertalanffy, 1968; Checkland, 1999; Sterman, 2000). For example, inadequate funding can interrupt procurement; interrupted procurement can reduce site productivity; reduced productivity can extend project duration; and prolonged duration can increase cost, creating further financial pressure. This systems perspective is particularly appropriate for Anambra State because the empirical results do not identify a single cause of delay; financial, bureaucratic, political, community and contractor-related factors jointly shape project performance.

Integration of the three perspectives: Endogenous Growth Theory explains *why* timely infrastructure matters for long-run economic performance; Project Management Theory explains *how* delivery processes can fail or succeed; and Systems Theory explains *why* isolated interventions are often insufficient. Together they support the conceptual argument that delay in public infrastructure is both a project-management problem and an economic-development constraint.

2.5 Conceptual Framework

The conceptual framework of the study links five interrelated constructs: (1) public infrastructure development (roads, buildings, utilities); (2) causes of delay (financial, institutional/bureaucratic, political, community and contractor-related); (3) delay in project delivery (schedule overrun); (4) economic consequences (perceived impacts on investment, employment, business activity and overall economic performance); and (5) mitigation measures (technology adoption, institutional strengthening, funding, policy reform and stakeholder engagement). The framework posits that delays, arising from multiple interrelated causes, are associated with adverse

economic consequences, and that an integrated set of mitigation measures can reduce those delays. Endogenous Growth Theory anchors the expected positive contribution of infrastructure to growth; Project Management and Systems Theory guide the analysis of delay causes and mitigation.

3. METHODOLOGY

The study adopted a descriptive survey research design. This design was considered appropriate because the research sought to obtain standardised perceptions from stakeholders directly involved in infrastructure delivery and to examine the association between delay and economic performance using quantitative techniques.

The study was conducted in Anambra State, located in the southeastern geopolitical zone of Nigeria. The state was selected because of its economic activity and the importance of public infrastructure to transportation, utilities, public services and commercial development.

3.1 Population of the Study

The study population comprised 475 stakeholders, including architects, builders, quantity surveyors, engineers, officials of the Ministry of Works and officials of the Ministry of Economic Planning and Budget. These categories were selected because they are directly involved in the planning, design, procurement, execution, supervision or financing of public infrastructure projects in the state. Population figures were obtained from professional registers and ministry staff lists current at the time of the study.

Table 1: Study Population by Stakeholder Group

Stakeholder group	Population	Percent (%)
Architects	68	14.3
Builders	90	18.9
Quantity Surveyors	28	5.9
Engineers	86	18.1
Ministry of Works	147	31.0
Ministry of Budget and Economic Planning	56	11.8
Total	**475**	**100.0**

3.2 Sample Size and Sampling Procedure

Sample size was determined using Yamane's (1967) formula for finite populations: $n = N / [1 + N(e)^2]$

where N = 475 and e = 0.05. This yielded a minimum sample of approximately 217. A combination of purposive and stratified random sampling was employed. Ministry officials and senior professionals with direct experience of public infrastructure projects were purposively included to ensure relevant expertise; within each professional stratum, respondents were then selected randomly from available registers. A total of 217 questionnaires were administered; 163 valid responses were retrieved, giving a response rate of

75.1%. This response rate is considered adequate for survey research of this type (Baruch & Holtom, 2008).

3.3 Research Instrument

Data were collected using a structured questionnaire organised into five sections corresponding to the study objectives: (A) infrastructure development and economic growth; (B) government policies and institutional performance; (C) causes of delay; (D) effects of delays on economic performance; and (E) measures for reducing delays. Items were measured on a five-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree). Items were adapted from previous studies on construction delay and infrastructure–growth relationships (Aghimien et al., 2020; Akinradewo et al., 2021; Alwashi et al., 2024) and refined for the Anambra context.

3.4 Validity and Reliability

Content and face validity were established through review by three senior academics in construction management and two practising professionals in Anambra State. Minor revisions to wording and item clarity were made on the basis of their feedback. Reliability was assessed using Cronbach's alpha. The overall instrument yielded $\alpha = 0.86$; subscale alphas ranged from 0.78 to 0.89, all exceeding the conventional threshold of 0.70 (Nunnally & Bernstein, 1994).

3.5 Operationalisation of Variables and Analytical Techniques

Composite scores for "delay in infrastructural development" and "economic growth / economic performance" were computed by averaging the relevant Likert items for each respondent. Higher scores on the delay composite indicate greater perceived severity of delay; higher scores on the economic-performance composite indicate stronger perceived adverse economic impacts of delay. Relative Importance Index (RII) was calculated as:

$$RII = \Sigma W / (A \times N)$$

where W is the weight given to each factor by respondents, A is the highest weight (5), and N is the total number of respondents. RII values were ranked and interpreted following standard practice in construction management research (values closer to 1 indicate higher relative importance).

Pearson Product Moment Correlation was used to test the hypothesis. Assumptions of linearity and approximate normality of the composite scores were examined via scatterplots and descriptive statistics; no serious violations were detected. Statistical significance was evaluated at $\alpha = 0.05$. All analyses were performed using appropriate statistical software.

4. RESULTS

All results reported below reflect stakeholders' perceptions. They should not be interpreted as direct measurements of GDP, employment or investment flow

4.1 Infrastructure Development and Economic Growth (Perceptions)

Table 2: Perceived Contribution of Infrastructure to Economic Performance

Indicator	Mean	RII	Rank
Attracts Investment	4.45	0.89	1st

Promotes Economic Growth	4.32	0.86	2nd
Drives Economic Expansion	4.27	0.85	3rd
Contributes to GDP	4.09	0.82	4th
Reduces Poverty	3.14	0.63	5th
Average		**0.81**	

The RII results show strong agreement that infrastructure is closely associated with economic performance. Investment attraction recorded the highest RII of 0.89, followed by promotion of economic growth (0.86) and economic expansion (0.85). Contribution to GDP recorded 0.82. The markedly lower RII of 0.63 for poverty reduction suggests that respondents were less certain about the direct poverty-reduction effect of infrastructure compared with its broader growth effects. This finding is consistent with literature that distinguishes growth effects from distributional outcomes and underscores the need for complementary social and employment policies (Todaro & Smith, 2020).

4.2 Government Policies and Infrastructure Delivery

Table 3: Perceived Performance of Government Policy and Institutions

Indicator	Mean	RII	Rank
Policy Challenges	3.68	0.74	1st
PPP Support	3.64	0.73	2nd
Policy Effectiveness	3.36	0.67	3rd
Stakeholder Involvement	3.32	0.66	4th
Procurement Transparency	3.05	0.61	5th
Average		**0.68**	

The results indicate only moderate performance of the policy and institutional environment. Policy challenges ranked highest, while procurement transparency ranked lowest. This pattern suggests that infrastructure delivery problems cannot be addressed solely by increasing capital expenditure; governance, accountability, procurement and administrative efficiency also require attention. The indicators were derived from previous institutional assessments of Nigerian infrastructure delivery (Alwashi et al., 2024; Aghimien et al., 2020) and refined for the present study.

4.3 Major Causes of Delay in Infrastructure Development

Table 4: Ranked Causes of Delay in Public Infrastructure Development

Cause	Mean	RII	Rank
Inadequate Funding	4.23	0.85	1st
Bureaucracy	4.18	0.84	2nd
Political Interference	4.09	0.82	3rd
Community Issues	3.91	0.78	4th
Contractor Issues	3.86	0.77	5th
Average		**0.82**	

Inadequate funding emerged as the leading cause of delay (RII = 0.85), followed closely

by bureaucracy (0.84). Political interference, community issues and contractor-related issues recorded 0.82, 0.78 and 0.77 respectively. The results indicate that delays are multidimensional and can be grouped into financial, institutional/bureaucratic, political, community and contractor categories. Financial interruptions may stop work directly, while bureaucratic and political constraints can slow approvals, procurement and decision-making. Community-related issues may affect site access and continuity, while contractor issues influence planning, supervision and resource mobilisation. The high average RII of 0.82 indicates a strong overall perception that the identified factors are important contributors to delay. Importantly, financial constraints are not isolated from institutional and governance problems: a project may have a budget allocation but still experience delay if funds are released late, approvals are slow or contract administration is ineffective.

4.4 Effects of Delays on Economic Growth (Perceived)

Table 5: Perceived Effects of Infrastructure Delays on Economic Performance

Effect	Mean	RII	Rank
Negative Economic Impact	4.00	0.80	1st
Reduces Investment	3.95	0.79	2nd
Reduces Employment	3.95	0.79	3rd
Affects Businesses	3.86	0.77	4th
Reduces Revenue	2.41	0.48	5th
Average		**0.73**	

Respondents perceived an overall adverse economic effect of infrastructure delays. “Negative economic impact” ranked first (RII = 0.80). Reduced investment and reduced employment each recorded 0.79, while effects on businesses recorded 0.77. Reduction in revenue was substantially lower (0.48), indicating less agreement on that specific pathway.

The dominant pattern shows that delays are perceived to postpone investment opportunities, disrupt business operations and reduce employment benefits that would otherwise arise during and after infrastructure delivery.

Note that "negative economic impact" is retained as a summary indicator; the more specific items (investment, employment, business activity) provide the detailed pathways.

4.5Measures for Reducing Delays

Table 6: Ranked Measures for Reducing Infrastructure Delays

Measure	Mean	RII	Rank
Technology Adoption	4.59	0.92	1st
Institutional Strengthening	4.41	0.88	2nd
Increased Funding	4.36	0.87	3rd
Policy Reform	4.23	0.85	4th
Stakeholder Engagement	4.18	0.84	5th
Average		**0.87**	

Technology adoption recorded the highest RII of 0.92. Respondents perceived digital project management, Building Information Modelling (BIM), Geographic Information Systems (GIS), electronic documentation and automated monitoring as highly important. Technology, however, should be implemented alongside appropriate professional capacity. Institutional strengthening ranked second (0.88), reinforcing the policy findings. Increased funding ranked third (0.87), confirming that financial adequacy remains necessary. Policy reform and stakeholder engagement also recorded high RII values (0.85 and 0.84). These rankings reflect respondent priorities rather than experimentally demonstrated causal effectiveness; pilot implementation and subsequent evaluation are recommended.

4.6Test of Hypothesis

Table 7: Pearson Correlation Result

Variables	N	Pearson r	Sig. (2-tailed)	Decision
Delay severity and perceived adverse economic impacts	163	0.820	$p < .001$	Reject H_0

The correlation coefficient of $r = 0.820$ indicates a very strong positive association between the severity of infrastructure delays and the severity of perceived adverse economic impacts. The significance value ($p <$
.001) is well below 0.05. The null hypothesis is therefore rejected. The finding indicates a statistically significant association in the study data.

Interpretation note: Because the economic-performance composite was constructed such that higher scores reflect stronger perceived negative economic consequences of delay, the positive correlation is consistent with the study's substantive argument. Pearson correlation establishes association, not causation. Economic performance may also be influenced by policy, institutional quality, financing conditions, governance, project management and other factors. Nevertheless, the correlation result, together with the RII findings, provides consistent empirical evidence that infrastructure delivery delays and economic performance are closely connected in the perceptions of stakeholders in Anambra State.

5. DISCUSSION OF FINDINGS

The findings establish that infrastructure is perceived as a major driver of economic growth through its ability to attract investment, improve productivity, reduce transaction costs, expand markets and support business productivity-enhancing role of public capital while remaining silent on

The study also demonstrates that effective infrastructure delivery depends strongly on institutional and policy frameworks. Policy challenges, weak procurement processes, bureaucracy and limited institutional capacity can undermine project implementation even where funding is available. Inadequate funding emerged as the leading cause of delay, followed closely by bureaucracy, political interference, community issues and contractor-related problems. These factors demonstrate that infrastructure delays result from interconnected financial, administrative, political, social and technical challenges consistent with Systems Theory.

Respondents perceived infrastructure delays to have significant economic consequences, particularly through reduced investment, employment opportunities and business performance. Delayed projects are seen to postpone the benefits expected from public investment,

distributional outcomes activities. However, infrastructure-led growth does not automatically guarantee poverty reduction or equitable distribution of benefits, highlighting the importance of complementary social and employment policies. This pattern is consistent with Endogenous Growth Theory, which emphasises the

increase operating and logistics costs, reduce productivity and limit market accessibility. Consequently, timely infrastructure delivery should be regarded not only as a construction management concern (Project Management Theory) but also as an important economic development imperative (Endogenous Growth Theory).

Respondents ranked technology adoption as the most important measure for reducing delays, followed by institutional strengthening and increased funding. Digital project management tools, BIM, GIS and electronic procurement are perceived as capable of improving coordination, monitoring, information sharing and decision-making. Institutional strengthening is equally important through clearer responsibilities, improved procurement systems, effective monitoring and transparent reporting. These rankings reflect stakeholder priorities; they do not constitute experimental proof of effectiveness.

6. CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

This study examined the impacts of delays in public infrastructure development on economic growth in Anambra State, Nigeria. The findings establish that infrastructure development is strongly associated, in stakeholder perceptions, with economic performance, particularly through investment attraction, growth, economic expansion and GDP contribution. At the same time, the evidence indicates that infrastructure projects do not automatically produce these benefits; their developmental value depends substantially on effective and timely delivery The empirical evidence shows that inadequate funding, bureaucracy, political interference, community issues and contractor-related challenges are important causes of delay.The economic consequences, as

perceived by respondents, include negative overall impact, reduced investment, reduced employment and disruption of business activities. The Pearson correlation result of $r = 0.820$ ($p < .001$) provides statistically significant evidence of a strong association between the severity of infrastructure delay and the severity of perceived adverse economic impacts. The null hypothesis was therefore rejected.

The study concludes that reducing infrastructure delays requires an integrated approach. Technology can improve planning, monitoring and coordination; institutions can improve governance and accountability; sustainable financing can support continuity; policy reform can reduce administrative bottlenecks; and stakeholder engagement can reduce social and coordination problems. The challenge is therefore not simply to spend more on infrastructure but to improve the system through which infrastructure investment is transformed into completed and operational assets.

6.2 Recommendations

The following recommendations are tied directly to the empirical findings:

1. **Technology and innovative project management (RII = 0.92).** Government and project stakeholders should incorporate BIM, GIS, digital scheduling, electronic document management and automated monitoring systems into infrastructure delivery. Professional training should accompany technology adoption. Pilot programmes with subsequent evaluation are recommended before statewide rollout.
2. **Institutional capacity (RII = 0.88).** Agencies responsible for infrastructure should improve procurement transparency, contract administration, inter-agency coordination, monitoring and accountability. Clear responsibility for approvals and project milestones should be established.
3. **Predictable and sustainable financing (RII = 0.85 for inadequate funding as a cause).** Budgetary allocations should be matched by realistic cash-flow plans and timely fund releases. Where appropriate, PPPs, infrastructure bonds and other financing mechanisms should complement public funding.
4. **Policy and administrative reforms (RII = 0.85).** Unnecessary approval stages should be reduced and consistency in infrastructure priorities improved. Changes to ongoing projects should be properly justified and managed to minimise disruption.
5. **Stakeholder and community engagement (RII = 0.84).** Early consultation, transparent communication and mechanisms for resolving community concerns should be strengthened throughout the project life cycle to reduce conflict and improve continuity.
6. **Project planning and risk management.** Feasibility assessment, realistic scheduling, design review, resource planning and risk registers should be strengthened before contract award to reduce avoidable delays.

6.3 Contribution to Knowledge

The study contributes state-specific empirical evidence to the infrastructure–economic growth literature. First, it demonstrates a strong statistical association between the severity of infrastructure delay and the severity of perceived adverse economic impacts using data from stakeholders directly

involved in infrastructure delivery in Anambra State. Second, it identifies a ranked set of major delay factors, with inadequate funding and bureaucracy at the top. Third, it documents the perceived economic consequences of delay in terms of investment, employment and business performance. Fourth, it links infrastructure delay to institutional and governance conditions rather than treating it solely as a contractor problem. Fifth, it provides an evidence-based hierarchy of mitigation measures as prioritised by respondents, placing technology adoption and institutional strengthening ahead of increased funding, policy reform and stakeholder engagement. These contributions are useful for construction management practice and sub-national infrastructure policy.

6.4 Limitations of the Study

Several limitations should be noted. First, the study relies on a cross-sectional survey of stakeholder perceptions rather than objective project completion records or macroeconomic time-series data; findings therefore reflect perceived rather than measured economic effects. Second, the sample, while adequate in size and response rate, is limited to selected professional and ministerial groups in Anambra State and may not fully represent all relevant stakeholders. Third, Pearson correlation establishes association, not causation. Fourth, possible response bias (including social desirability) cannot be entirely ruled out. Fifth, the RII method, while widely used, is essentially descriptive and does not test statistical significance of rank differences. These limitations constrain the generalisability of the findings and the strength of causal claims.

6.5 Suggestions for Further Research

Future studies should consider: (a) longitudinal designs that track specific projects from inception to completion and link delay duration to subsequent economic indicators; (b) integration of objective data (budget releases, actual completion rates, employment and business-registration statistics); (c) project-level case studies that measure delay in calendar days and associated cost overruns; (d) comparative studies across multiple Nigerian states; and (e) evaluation of the actual effectiveness of technology and institutional interventions through pilot programmes with control or comparison groups.

REFERENCES

Adewunmi, Y. A., Ojo, S. O., & Adenuga, O. A. (2022). Digital technologies and construction project performance in Nigeria. *Journal of Construction Business and Management, 6*(1), 14–26.

Afolayan, A. S., & Olatunji, O. A. (2022). Design management practices and project delivery performance in the Nigerian construction industry. *Journal of Construction Business and Management, 6*(2), 45–58.

Afolayan, A. S., Olatunji, O. A., & Awodele, O. A. (2023). Adoption of building information modelling for improved project delivery in Nigeria. *Journal of Construction Project Management and Innovation, 13*(1), 45–60.

African Development Bank. (2024). *African economic outlook 2024*. African Development Bank Group.

Aghimien, D. O., Aigbavboa, C. O., & Oke, A. E. (2021). Critical success factors for infrastructure project delivery in developing countries. *Built Environment Project and Asset Management, 11*(2), 190–205.

Aghimien, D. O., Oke, A. E., Aigbavboa, C. O., & Ogunde, A. O. (2020). Managing construction project delays in developing countries: A Nigerian perspective. *Built Environment Project and Asset Management, 10*(5), 597–615.

Ajayi, B. O., & Chinda, T. (2022). Impact of construction delay-controlling parameters on project schedule: DEMATEL-system dynamics modeling approach. *Frontiers in Built Environment, 8*, 799314. https://doi.org/10.3389/fbuil.2022.799314

Akinradewo, O. F., Oyedele, L. O., & Omirin, M. M. (2021). Infrastructure investment, project delays and economic performance in developing countries. *Journal of Construction Engineering and Management, 147*(6), 04021045.

Alwashi, D. J., Waziri, A. Y., Mohammad, S. A., & Inuwa, I. I. (2024). Institutional factors influencing construction project delays in Nigeria. *African Journal of Built Environment Research, 6*(1), 45–58.

Anambra State Government. (2024a). *Medium-Term Expenditure Framework (MTEF) 2024–2026*. Government of Anambra State.

Anambra State Government. (2024b). *2024 Fourth Quarter Budget Performance Report*. Government of Anambra State. Azolibe, C. B., & Okonkwo, C. I. (2020). Infrastructure development and economic growth in Nigeria. *International*

Journal of Development and Management Review, 15(1), 89–104.

Barro, R. J. (1990). Government spending in a simple model of endogenous growth. *Journal of Political Economy, 98*(5), S103–S125.

Baruch, Y., & Holtom, B. C. (2008). Survey response rate levels and trends in organizational research. *Human Relations, 61*(8), 1139–1160.

Bertalanffy, L. von. (1968). *General system theory: Foundations, development, applications*. George Braziller. Calderón, C., & Servén, L. (2014). *Infrastructure, growth, and inequality: An overview*. World Bank.

Checkland, P. (1999). *Systems thinking, systems practice*. Wiley.

Flyvbjerg, B., Skamris Holm, M. K., & Buhl, S. L. (2003). How common and how large are cost overruns in transport infrastructure projects? *Transport Reviews, 23*(1), 71–88.

Ismaila, U., Jung, W., & Park, C. Y. (2022). Delay causes and types in Nigerian power construction projects. *Energies, 15*(3), 814. https://doi.org/10.3390/en15030814

Isyaku, L. M., Kasimu, M. A., & Nasiru, A. M. (2020). Construction project delay and performance in Nigeria. *Journal of Engineering and Applied Sciences, 15*(3), 145–156.

Kerzner, H. (2017). *Project management: A systems approach to planning, scheduling, and controlling* (12th ed.). Wiley. Lucas, R. E. (1988). On the mechanics of economic development. *Journal of Monetary Economics, 22*(1), 3–42.

Nunnally, J. C., & Bernstein, I. H. (1994). *Psychometric theory* (3rd ed.). McGraw-Hill.

Ogunde, A. O., Dafe, O. E., Akinola, G. A., Ogundipe, K. E., Oloke, O. C., Ademola, S. A., Akuete, E., & Olaniran, H. F. (2017). Factors militating against prompt delivery of construction projects in Lagos mega city, Nigeria: Contractors' perspective. *Mediterranean Journal of Social Sciences, 8*(3), 233–242.

Romer, P. M. (1986). Increasing returns and long-run growth. *Journal of Political Economy, 94*(5), 1002–1037.

Sanni-Anibire, M. O., Mohamad Zin, R., & Olatunji, S. O. (2020). Causes of delay in the global construction industry: A meta-analytical review. *International Journal of Construction Management, 20*(6), 1–13.

Sterman, J. D. (2000). *Business dynamics: Systems thinking and modeling for a complex world*. McGraw-Hill. Todaro, M. P., & Smith, S. C. (2020). *Economic development* (13th ed.). Pearson.

Unegbu, H. C. O., Yawas, D. S., Dan-asabe, B., & Alabi, A. A. (2024). Assessment of sustainable construction practices and their impact on physical development in Nigeria. *Nigerian Journal of Technological Development, 21*(1), 33–42.

Voice of Nigeria. (2024a). Anambra approves N16.7 billion infrastructure drive. *Voice of Nigeria.*

Voice of Nigeria. (2024b). NITP urges Anambra to develop comprehensive urban master plans. *Voice of Nigeria*. World Bank. (2022). *Nigeria development update: The continuing urgency of business unusual*. World Bank.

Yamane, T. (1967). *Statistics: An introductory analysis* (2nd ed.). Harper & Row