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CONSTRUCTION PROJECT PERFORMANCE AND THE DIGITAL DEFICIT: EVIDENCE FROM 52 COMPLETED BUILDING AND ROAD PROJECTS IN ONDO STATE, NIGERIA

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Abstract

Construction project delivery in Nigeria is characterised by persistent time and cost overruns that undermine infrastructure investment and the provision of public services. This study examines project performance in Ondo State, Nigeria, through archival analysis of 52 completed construction projects and a questionnaire survey of 29 construction professionals, and proposes a targeted Digital Intervention Framework (DIF) for the five highest-ranked efficiency constraints. A quantitative mixed-method design was adopted: archival records yielded descriptive performance statistics, while the Relative Importance Index (RII) and Relative Significance Index (RSI) were computed. Findings reveal severe delivery underperformance: 72.97% of building projects and 93.33% of road projects exceeded their contract duration, with mean time overruns of 20.81% and 26.00% respectively; 75% of building projects and all road projects exceeded their contract cost, with mean cost overruns of 12.78% and 19.33% respectively. The five highest-ranked efficiency constraints are adequate planning (RII = 3.975), number of reworks (RII = 3.828), payment delays (RII = 3.586), cost control systems (RII = 3.483), and information coordination (RII = 3.414). These findings are limited to Ondo State, which constrains direct generalisation; however, the sample comprises experienced multidisciplinary practitioners whose cross-professional perspective strengthens the credibility of the factor rankings. The DIF proposed in this paper maps each of the five priority efficiency factors to specific digital tools appropriate to the infrastructure and capacity context of Nigerian small construction firms, offering practical guidance for construction clients, contractors, consultants, and policymakers seeking to reduce project overruns through digital transformation.

Keywords: Construction project performance; time overrun; cost overrun; digitalisation; Nigeria; Ondo State; digital project management.

Introduction

The persistent Failure of construction projects to be completed on schedule and on budget is one of the most widely examined and least solved issues in the international construction management literature (Kusonga et al., 2025). The situation is especially severe in Nigeria (Adedokun et al, 2019). The poor performance of successive government administrations in delivering infrastructure projects roads, schools, hospitals, housing, government offices, many of which are not finished years after their scheduled completion or at costs that are well in excess of their original contract values, is well documented (Asaju, 2023). The economic and social impact of this is significant: infrastructure delay is delay in the provision of public services; prolonged disruption of communities in which the projects are located; wasted government investment in incomplete projects; and a lack of public trust in the construction industry's ability to deliver value for money (Aibinu & Jagboro, 2002; Ogunsemi & Jagboro, 2006).

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A very large body of research exists on the causes of time and cost overruns in construction projects in Nigeria, dating back to at least the 1990s and covering a range of states, project types and professional viewpoints (Kaming et al.,1997; Aibinu & Jagboro, 2002; Ogunsemi & Jagboro, 2006; Kasimu, 2012). The upshot of this research is that the major systemic causes of poor project performance are inadequate planning, delayed payments, information management, and cost control; a finding supported by research on construction management practices in similar developing economies in Sub-Saharan Africa and South Asia. Less well documented, especially in the Nigerian case, is how digital tools can help to overcome these systemic causes. The rapid uptake of Building Information Modelling (BIM), digital project management systems, cloud-based collaborative working platforms and real-time cost control systems in the global construction industry has produced an evidence base showing that digital tools do indeed help to reduce time and cost overruns, but this evidence base has not been systematically brought to bear on the Nigerian construction sector (Aghimien et al., 2022; Naji et al., 2024; Gledson et al., 2024).

This paper provides both empirical and prescriptive evidence. Empirically, it provides archival performance data for 52 completed construction projects (37 buildings and 15 roads) in Ondo, Nigeria, showing time and cost overruns significantly greater than those reported in opinion polls in the literature (especially for road infrastructure projects, where all projects exceeded the contract sum). Prescriptively, it links the five most important factors affecting efficiency to targeted digital interventions tailored to the Nigerian small construction firm environment, presenting a Digital Intervention Framework (DIF) for construction firms in Ondo State and other Nigerian settings, offering a practical, evidence-based guide to digital transformation.

This paper makes three contributions. First, it offers limited empirical evidence from project records rather than experts' opinions, a methodological difference that is important because opinion surveys capture perceived causes while archival data capture outcomes. Second, it shows a statistically significant difference in the performance between building and road construction projects, which has not been reported before in Ondo State, with road projects performing much better than building projects in terms of time and cost overruns. Third, it provides evidence of a connection between the highest-ranking efficiency factors and digital tools, making the case for digitalisation and showing that it is not merely an overlay of the empirical evidence.

Literature Review

Construction Project Efficiency Theory

Construction project efficiency is traditionally measured against three main criteria: time, cost and quality, the "iron triangle" of the construction project management (Atkinson, 1999). A construction project is considered efficient if it is delivered on time (i.e., within the contract time), on or under budget (i.e., within the contract cost), and meets the required quality standards (i.e., the client's quality requirements) (Adedokun et al., 2019). In reality, it is rare that all three criteria are simultaneously achieved on a single project, and the trade-offs among the criteria, speeding up a project to minimise time overrun often increases cost; minimising cost by reducing specification often leads to reduced quality, which is a key challenge in construction project management.

Time overrun is the difference between the actual and the scheduled completion of the project, expressed as a percentage of the original contract duration (Kaming et al., 1997). Cost overrun is defined as the difference between the actual cost of project and the original contract sum, expressed as a percentage of the original contract sum (Chan, 2001). These two measures are derived from archival data (as in this study) rather than estimates based on expert opinion, a methodological improvement over the "mainstream" approach in the Nigerian construction performance literature.

Chan & Kumaraswamy (1997) confirmed the fact that time and cost overruns are endemic to the delivery of construction projects in developing economies, and are caused by a mix of project and systemic factors - project-specific (design changes, site conditions, contractor performance) and systemic (payment systems, planning processes, information management). Enshassi et al. (2007) undertook a similar study of the Gaza Strip, yielding findings consistent with the Nigerian evidence. The fact that the same problems are found in geographically distinct developing-economy construction markets implies that the causes are systemic rather than unique to a given project or location, a result that has implications for what kinds of changes will be effective in bringing about sustained improvement.

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Review of Evidence from Construction Performance in Nigeria

The most notable empirical examination of the effects of delay in Nigerian construction projects is that of Aibinu & Jagboro (2002), who analysed 61 building projects and concluded that "time overload is more the rule than exception" and that time and cost overruns are common. Their main recommendations to mitigate delay effects were enhanced owner project management procedures and pre-contract allowances, which have not received significant attention in the last two decades of Nigerian construction research (despite an increase in the theoretical literature).

Ogunsemi & Jagboro (2006) proposed a time-cost model for Nigerian building projects, demonstrating a statistically significant correlation between construction time and total cost and offering a model for pre-contract cost prediction. Kasimu (2012) ranked market factors, material price variation and political factors as the major cost-overrun factors in the Nigerian building sector, which partly corroborates the factor ranking in the present study, but downplays the significance of planning and information management problems.

Dada (2013) investigated the impact of procurement on construction performance and found that design-bid-build, the main procurement method used in Ondo State public sector projects, has the highest time and cost overrun among the procurement methods examined. This insight contextualises the present study's data, which was collected from mostly design-bid-build projects, and provides evidence that procurement reform is not a replacement but a complementary approach to digital tools for improving construction performance. Several authors have also discussed time and cost overrun in different dimensions in literature (Adedokun et al., 2019; Mahmud et al., 2021; Asaju, 2023; Ikwueze & Ejiofor, 2024)

Digital Tools and Construction Project Performance

The impact of adopting digital tools on the performance of construction projects is well documented in developed construction markets and increasingly in African and other emerging markets. The most studied digital construction tool, BIM, has been demonstrated to minimise design coordination errors (clash detection), support pre-construction planning (4D simulation), enable more reliable early-stage cost forecasting, and support the information sharing between project stakeholders that is consistently identified in the Nigerian literature as a key efficiency constraint (Fonseca Arenas & Shafique, 2023; Naji et al., 2024).

Gledson et al. (2024) showed that digital leadership and well-organised digital transformation projects in construction organisations enhance project cost and time variance, confirming that the performance benefits of digital tools are not automatic but require specific organisational investment in technology and human capacity building. Aghimien et al. (2022) established that in the Nigerian construction sector, the constraints on digital adoption - the cost of technology, lack of digital skill and weak ICT infrastructure - are well known and can be addressed through institutional and organisational support. Oke et al. (2023) demonstrated that Nigerian construction professionals who adopt digital project management tools report superior project delivery performance to those who do not, laying a preliminary foundation for the digitalisation-performance relationship in Nigeria.

In the road construction sector in particular, where this study shows the most pronounced delivery performance gaps, digital tools such as geographic information system-based asset management, digital geotechnical evaluation tools, internet of things-based structural monitoring, and digital payment systems for contractor valuations have been shown to improve performance in similar Sub-Saharan African contexts (Dagou et al., 2025). The absence of any road project cost performance delivered on budget in this study's sample suggests that the performance deficit in this sector is so severe that it may be described as a crisis, and that it can be partly addressed by digital tools.

Theoretical Framework

This research draws on the iron triangle (time, cost, and quality as the three key aspects of construction project performance; Atkinson, 1999) model, augmented by the dynamic capabilities perspective (Teece, 2007) to include the adoption of digital tools as an organisational capability that increases the ability to efficiently deliver projects. The dynamic capabilities perspective is well-suited to this study because it views digital transformation as an ongoing process of organisational capability development, rather than a one-off technology investment: firms that invest in digital project management build a self-reinforcing cycle of improvement in their organisational capabilities, each project feeding forward to improve the next.

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The Digital Intervention Framework (DIF) proposed in Section 5 of this paper applies this theory to the particular efficiency factors that emerged from the empirical data, linking each factor to a digital tool capability and considering the infrastructure needs and implementation barriers in the context of Nigerian small construction firms.

Research Methodology

Research Design

This research adopted a quantitative mixed-methods design, which involved the collection of two types of data: archival data on project performance records and a questionnaire survey (Das et al., 2018). This is the major contribution of this study to previous research on Nigerian construction performance, which has almost exclusively relied on professional opinion surveys to infer patterns of construction performance. The archival data provide an objective measure of performance; the questionnaire data provide a professional opinion on the causes of the performance patterns found in the archival data. Combined, they provide a stronger analysis than either data source alone.

Archival Data Collection

Data on project and contract records were gathered from contracting and consulting firms and government ministries in Ondo State. Project records were sought for completed projects with known proposed contract duration/cost and actual completion duration/cost, allowing calculation of the time and cost overrun percentages. Information was obtained for 37 buildings and 15 roads, a total of 52 projects. The historical data include: proposed contract duration in weeks; actual contract duration in weeks; time overrun in weeks; percentage time overrun; proposed contract sum in naira; actual contract cost in naira; cost overrun in naira; and percentage cost overrun. Projects with cost data but no time data (or vice versa) were included in the analysis related to that data only; there are slight variations in the "n" values in the tables for the time and cost analyses.

Questionnaire Survey

The questionnaire was distributed to 29 professionals in Ondo State, comprising quantity surveyors (27.59%), builders (24.14%), engineers (17.24%), architects (10.34%), and others who did not specify their profession (20.69%). The professionals were from consulting firms (58.62%) and contracting firms (34.48%). The average professional experience is 10.78 years (modal class: 5-10 years, 41.34%), indicating that respondents' professional knowledge is adequate for the study. The questionnaire contained 58 factors affecting construction project delivery efficiency, rated on a 5-point scale (1 = Very high impact, 5 = No impact). Twenty-nine responses were usable, yielding a response rate of 72.5% for the 40 questionnaires sent. The sample size of n = 29 used reflects the restricted population of registered construction professionals actively practising in Ondo State at the time of the survey. The study adopted a purposive sampling approach, targeting practitioners with direct project delivery experience, prioritising depth and relevance of professional knowledge over sample breadth. The 72.5% response rate is considered acceptable for a purposive expert sample in construction management research (Aghimien et al., 2022).

Data Analysis

Time and cost overrun percentages were calculated from archival records using the formulas given below:

$$\textit{Time overrun (\%)} = [(\textit{Actual duration} - \textit{Proposed duration}) / \textit{Proposed duration}] \times 100$$

$$\textit{Cost overrun (\%)} = [(\textit{Actual cost} - \textit{Proposed cost}) / \textit{Proposed cost}] \times 100$$

Descriptive statistics, mean, frequency distributions, and modal classes were computed for the archival performance data. For the questionnaire data, Relative Importance Index (RII) and Relative Significance Index (RSI) were calculated as:

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

$$RSI = \Sigma(w) / (5 \times N)$$

where w is the weighting assigned by each respondent (1 to 5), A is the highest weight (5), and N is the total number of valid respondents (29). Factors were ranked from highest to lowest RII value. The Digital Intervention Framework was developed by mapping the five highest-ranked factors to specific digital tools and assessing infrastructure requirements against the criteria of Aghimien et al. (2022) for the Nigerian construction context.

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Results and Analysis

Respondent Profile

Table 1 presents the profile of the 29 respondents to the questionnaire. The respondents' construction experience is well-suited to the research: 58.62% have over 5 years of experience in the construction industry, with an average of 10.78 years. The representation of different professionals (quantity surveyors, builders, engineers and architects) in the sample ensures that the factor rankings are drawn from a cross-professional perspective rather than a single group's view.

Table 1: Respondent Background Characteristics (n = 29)

Variable	Category	Frequency	Percentage (%)
Nature of organisation	Consulting firm	17	58.62
	Contracting firm	10	34.48
	Not indicated	2	6.90
	Total	**29**	**100.00**
Academic qualification	HND	11	37.93
	BSc/BTech	10	34.48
	MSc/MTech	5	17.24
	PGD	2	6.90
	PhD	1	3.45
	Total	**29**	**100.00**
Professional body	NIQS (Quantity Surveyor)	8	27.59
	NIOB (Builder)	7	24.14
	NSE (Engineer)	5	17.24
	NIA (Architect)	3	10.34
	Not indicated	6	20.69
	Total	**29**	**100.00**
Years of experience	0–5 years	6	20.69
	5–10 years	12	41.34
	10–15 years	5	17.24
	15–20 years	1	3.45
	20 years and above	5	17.24
	Total	**29**	**100.00**

Source: Field survey, 2025

Time Performance Archival Analysis

Table 2 presents the time performance for the 52 projects (37 buildings and 15 road projects) with time data. The fact that 72.97% of building projects and 93.33% of road projects exceeded the contracted completion time is consistent with previous studies in the Nigerian construction performance literature (Aibinu & Jagboro, 2002; Ogunsemi &

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Jagboro, 2006) but offers archival evidence from post-completion projects in Ondo State in particular. The statistical difference in time performance between building and road projects, with average time overruns of 20.81% and 26.00% respectively, is noteworthy: the mean time overrun for road projects is 25.1% (relative to their contracted time) higher than that for building projects.

The modal time overrun categories for both building and road projects are 0-20%. Time overruns are almost universal; most are within a range that, with proper contingency management and better planning, is theoretically avoidable through improved pre-contract project planning. The right tail of the distribution is more troubling: 5.41% of building projects and 6.67% of road projects experience time overruns exceeding 80%; these are "project failures" that cannot be explained by planning variability and reflect fundamental problems in monitoring and controlling projects.

Table 2: Time Performance Summary of Building and Road Projects

Project Type	n	Within duration	Exceeded duration	Mean overrun (%)	Modal class	Modal frequency
Building projects	37	10 (27.03%)	27 (72.97%)	**20.81%**	0–20%	51.35%
Road projects	15	1 (6.67%)	14 (93.33%)	**26.00%**	0–20%	60.00%

Source: Archival project records, Ondo State, 2025. Time overrun (%) = [(Actual − Proposed duration) / Proposed duration] × 100

Cost Performance Archival Analysis

Table 3 presents the cost-performance distribution. The findings reveal that all road projects (15) in the sample exceeded their contract sum. None of the road projects was completed within budget. The average cost overrun for road projects is 19.33%, significantly higher than the 12.78% average for building projects. Although cost overruns for individual road projects range from 4.29% to 38.80%, none of the projects was delivered within budget, implying that the procurement conditions of road projects in Ondo State (such as procurement route, contractual provisions, payment practices and site assessment) tend to result in cost escalation, regardless of project size and contractor capacity.

While building projects are also mainly over budget (75.00% exceeded their contract sum), they exhibit greater variability: 11.11% were delivered under budget, and 25.00% were delivered within budget. This variability in the cost performance of building projects, compared to the uniformity of road project overruns, implies that building construction is a category of work with a more diverse cost performance - there are firms and/or project types that achieve cost delivery and others that do not - while road projects in Ondo State are a category of work with a consistent outcome of poor performance requiring systemic rather than firm-specific intervention.

Table 3: Cost Performance Summary of Building and Road Projects

Project Type	n	Within budget	Exceeded budget	Mean overrun (%)	Modal class	Modal frequency
Building projects	36	9 (25.00%)	27 (75.00%)	**12.78%**	0–20%	66.67%
Road projects	15	0 (0.00%)	15 (100.00%)	**19.33%**	0–20%	53.33%

Source: Archival project records, Ondo State, 2025. Cost overrun (%) = [(Actual cost − Proposed cost) / Proposed cost] × 100

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Table 4: Comparative Performance of Building vs Road Projects

Performance Indicator	Building Projects	Road Projects	Analytical observation
Time overrun (mean)	20.81%	26.00%	Road projects 25.1% worse
Time overrun (projects exceeding duration)	72.97%	93.33%	Road 28% more likely to overrun
Cost overrun (mean)	12.78%	19.33%	Road projects 51.2% worse
Cost overrun (projects exceeding budget)	75.00%	100.00%	Every road project exceeded the budget
Projects within budget	25.00% (9 of 36)	0.00% (0 of 15)	No road project in the study was delivered within the contract sum
Modal time overrun class	0–20% (51.35%)	0–20% (60.00%)	Both concentrated in the lower overrun band
Extreme overrun (>80%)	5.41%	6.67%	Similar small proportions at the extreme range

Source: Archival project records, Ondo State, 2025

Every road project in the sample exceeded its contract sum. This is not a statistical outlier, it is a finding of complete uniformity that points to a structural procurement and cost management failure in road infrastructure delivery in Ondo State, not a series of individual project failures.

Factors Influencing Construction Project Delivery Efficiency

Table 5 presents the top 10 factors from the 58-factor RII/RSI analysis, along with the digital intervention to be applied to each factor. The appendix shows the ranking for the 58 factors. The first-ranked factor is adequate planning (RII = 3.975; RSI = 0.793), consistent with the study of Benedict et al. (2015) for Imo State and Juliet et al. (2014) for Niger State, confirming that planning inadequacy is the most widely recognised systemic constraint on construction project delivery efficiency across multiple Nigerian states. The number of reworks ranks second (RII = 3.828; RSI = 0.766), with a direct digital solution (as building information modelling-based clash detection significantly reduces the design coordination errors, the main cause of construction rework). Average delay in payment from owner to contractor (RII = 3.586; RSI = 0.717) is third, and cost control systems (RII = 3.483; RSI = 0.679) and information coordination (RII = 3.414; RSI = 0.682) are fourth and fifth, respectively. The top five factors form an internally consistent cluster of administrative, information management, and financial management failures, all of which have clear digital solutions, rather than merely technical or site-specific issues.

Table 5: Top Ten Factors Influencing Delivery Efficiency with MII, RSI Rankings, and Digital Interventions

Rank	Factor	RII	RSI	Rank	Level	Digital intervention
1	Adequate planning	**3.975**	0.793	1st	High	Digital project management, BIM 4D scheduling, Primavera P6, MS Project
2	Number of reworks	**3.828**	0.766	2nd	High	BIM clash detection, IoT quality control, digital defect tracking apps
3	Average delay in payment from owner to contractor	**3.586**	0.717	3rd	High	Blockchain smart contracts, digital payment platforms, mobile invoice processing

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4	Cost control system	**3.483**	0.679	4th	High	Digital cost management software (CostX, QClouding), real-time budget dashboards
5	Information coordination among owner and project parties	**3.414**	0.682	5th	High	BIM Common Data Environments (CDE), cloud-based collaboration, mobile site apps
6	Complexity of project productivity	**3.241**	0.648	6th	Moderate	Digital productivity tracking, AI-assisted resource scheduling, IoT site monitoring
7	Cost of variation orders	**3.241**	0.648	6th	Moderate	Digital change management systems, BIM model-based variation cost calculation
8	Neighbour and site condition problems	**3.103**	0.621	8th	Moderate	Geophysical digital mapping, GIS-based site assessment, drone site surveys
9	Climatic condition	**2.931**	0.586	9th	Moderate	Weather API integration with scheduling software, IoT environmental sensors
10	Efficiency and effective procurement method	**2.931**	0.586	9th	Moderate	E-procurement platforms, digital tender management, BIM-based procurement

RII range interpretation: 3.50–4.49 = High significance; 2.50–3.49 = Moderate significance. Digital interventions assessed for Nigerian small construction firm context.

Source: Field survey, 2025

Digital Intervention Framework for Construction Project Efficiency in Nigeria

The Digital Intervention Framework (DIF) in Table 6 maps the top five efficiency constraints identified in this study to specific digital tools, root-cause mechanisms, infrastructure needs, and direct empirical correlations. The DIF is not a blanket digitalisation recipe but a localised framework, supported by this study's empirical findings, and adapted to the infrastructure and capacity needs of small to medium-sized indigenous construction firms in Ondo State and elsewhere in Nigeria.

Table 6: Digital Intervention Framework (DIF) for Five Priority Efficiency Constraints

Efficiency Factor	Root cause mechanism	Digital intervention	Infrastructure requirement	Linkage to study findings
Planning deficit (Rank 1, RII=3.975)	Poor upfront project planning; inadequate pre-construction preparation	4D BIM scheduling; Primavera P6; MS Project; digital work breakdown structure tools	Low; widely available software; key barrier is skills and adoption culture	Digital planning tools reduce schedule overruns by enabling simulation of project sequences before construction starts; Nigerian studies confirm planning as the primary driver of time overrun
Rework frequency (Rank 2, RII=3.828)	Design coordination failures; quality control gaps; poor	BIM clash detection (Navisworks, Revit); IoT-based quality inspection; digital defect tracking apps (Snag-R, PlanGrid)	Medium; requires BIM model and compatible software	Road projects in this study show 93.33% time overrun; rework is a key contributor; BIM clash detection prevents design errors before they reach site

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	specification compliance		across design team	
Payment delays (Rank 3, RII=3.586)	Manual invoicing; slow client approval processes; cash flow constraints	Digital payment platforms; blockchain smart contracts; mobile invoice processing; NHF digital payment integration	Low-Medium; mobile payment infrastructure already exists in Nigeria (OPay, Flutterwave)	72.97% of building projects and 100% of road projects exceed budget; payment delays compound cost escalation; digital payment systems can reduce approval cycle time significantly
Cost control gaps (Rank 4, RII=3.483)	Manual cost tracking; inadequate progress-to-budget comparison; absence of real-time cost data	Digital cost management software (CostX, QClouding); cloud-based quantity surveying platforms; real-time project budget dashboards	Low-Medium; cloud-based QS tools accessible via subscription; no specialist hardware required	Mean cost overrun in building (12.78%) and road (19.33%) projects would be reduced by real-time cost tracking that flags overrun early enough for corrective action
Information gaps (Rank 5, RII=3.414)	Poor information flow between owner, consultant, and contractor; fragmented communication	BIM Common Data Environments (CDE); cloud-based project collaboration platforms; mobile site management apps	Medium; requires consistent internet connectivity and device access across the project team	Information coordination failures compound all other efficiency factors; CDEs establish a single source of truth accessible to all project participants in real time

Infrastructure requirements: Low = smartphone and mobile internet only; Low-Medium = smartphone and basic firm digital accounting; Medium = BIM-capable workstation and collaborative platform; High = integrated BIM and IoT infrastructure.

Source: Authors' synthesis from empirical findings and digital construction literature.

Planning: The Top Digital Investment

Poor planning is the foremost efficiency constraint (RII = 3.975), which is consistent with the Nigerian construction performance literature and directly reflected in the findings of this study, that 72.97% of building projects and 93.33% of road projects exceeded their contract duration. BIM-based 4D scheduling enables project teams to simulate construction sequences and detect resource conflicts before site mobilisation, providing the early warning system that manual scheduling cannot (Martins et al., 2022; Agbehadji et al., 2023). For firms not yet at BIM readiness, Microsoft Project and Primavera P6 offer a lower-cost entry point that still delivers significant improvements in schedule discipline relative to paper-based planning.

Digital Quality Management to Reduce Rework

Rework is the second-ranked constraint (RII = 3.828) and a direct driver of cost overrun: it consumes labour and materials without adding project value (Mahamid, 2022). BIM clash detection (Navisworks, Revit) resolves design coordination failures between structural, architectural, and MEP elements in the virtual model before they are built into the structure, eliminating the most frequent trigger for rework (Teo et al., 2022). For firms not yet BIM-ready, low-cost digital defect-tracking apps (Snag-R, PlanGrid) provide an electronic audit trail of defects, assignments, and closures that paper-based quality management cannot match and are available for Android devices at minimal or no cost in the Nigerian market (Adeogun, 2024).

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Billing and Payment

Payment delays rank third (RII = 3.586) and create compounding downstream effects: a contractor without regular interim payments cannot pay subcontractors, procure materials on schedule, or maintain the workforce, generating further time and cost overruns beyond the delay itself. The finding that 100% of road projects exceeded their contract sum, compared with 75% of building projects, reflects the additional layer of government budget release and bureaucratic approval cycles that characterise public-sector infrastructure procurement. Digital payment platforms already operational in Nigeria (Flutterwave, Paystack, OPay) reduce the payment cycle from weeks to days; blockchain smart contracts offer a further step, tying payment release automatically to verifiable milestone completion on a distributed ledger and minimising dispute risk (Jacob & Umohb, 2024; Pham et al., 2025).

Cost Control and Information Coordination

Cost control (RII = 3.483, Rank 4) and information coordination (RII = 3.414, Rank 5) operate as reinforcing constraints: undetected cost overruns compound payment disputes, while fragmented information among the owner, consultant, and contractor generates the rework and miscommunication that underpin both time and cost overruns. Cloud-based cost management platforms (CostX, QClouding) track expenditure against budget in real time, automatically price variation orders, and flag impending overruns early enough for corrective action, directly targeting the mean cost overruns of 12.78% (building) and 19.33% (road) documented in this study (Aigbavboa & Kissi, 2025). BIM Common Data Environments (CDEs) address information fragmentation by establishing a single versioned information repository accessible simultaneously to every project party, replacing the multi-format, sequential exchange that currently characterises owner-consultant-contractor communication in Ondo State; infrastructure requirements are assessed as medium given prevailing connectivity and digital skill levels (Jaskula et al., 2025; Goodluck, 2021).

Discussion

The use of historical project data and factor ranking analysis in this study yields a series of findings that are individually consistent with the current state of knowledge in the Nigerian construction industry performance literature, but collectively more worrying than any factor-ranking study alone has reported. The fact that 93.33% of road projects overrun contracted time, 100% overrun contracted cost, and that inadequate planning and information co-ordination are the most significant efficiency constraints, suggests that the construction sector is poorly equipped (in terms of project management tools, digital technology and organisational processes) to efficiently produce road infrastructure (Abdullahi et al., 2023). This is a performance issue that cannot be solved by better contract terms, penalty provisions and on-site supervision. It calls for enhancing the project management systems, planning, cost control, payment systems, and information systems that are integral to the operation of construction firms.

Comparing the performance of building and road projects is revealing. Building projects, although they are generally over budget and over time, display the variability in performance (some projects delivered on time, some on budget, some under budget) characteristic of a sector where firm-specific and project-specific attributes matter (Kose et al., 2022). By contrast, road projects show no such variability: 93.33% time overrun rate and 100% cost overrun rate are not a distribution with high-performing outliers that pull up the average; they are the result of a generalised failure of road projects to perform.

This accounts for what digitalisation means. In building construction, digitalisation improves individual firms' project management (through BIM, digital cost management software, and mobile site management apps), thereby harnessing the performance improvements implied by variability in existing data. For road construction, the evidence suggests systemic causes procurement route, payment mechanism design, site investigation quality, and contractor selection criteria that have to be addressed at the industry or government level, rather than firm or contractor level (Adaku et al., 2024). Digital technologies for road construction should therefore focus on the systemic level: e-procurement platforms to improve contractor selection, digital payment systems to remove bureaucratic payment delays, road asset management systems to improve site assessment before tendering, and digital measurement systems to give government clients real-time project performance reports as opposed to monthly or quarterly written reports (Abdullahi, 2023).

That poor planning is the topmost of 58 factors identified is not new. it is in line with construction performance studies from Nigeria and other developing countries (Aliyu et al., 2023). What is new

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is the fact that this insight is combined with archival data to quantify the planning deficiency in terms of time and cost.

Conclusions and Recommendations

Conclusions

This research has examined the efficiency of construction project delivery in Ondo State, Nigeria, via archival research of 52 past projects and a questionnaire survey of 29 professionals. Five main conclusions are put forward.

First, the time performance of construction projects in Ondo State is appalling. The time performance of 72.97% of building projects and 93.33% of road projects is unacceptably bad (mean time overrun 20.81% and 26.00% respectively).

Second, the situation with the construction project cost is worse. Seventy-five percent of building projects overrun their contract cost (mean overrun 12.78%), while all road projects in the sample (15 projects) exceeded their contract cost (mean overrun 19.33%). The absence of any road project cost performance within budget is due to extreme severity, requiring policy focus on the road sector.

Third, road construction projects consistently and markedly outperform building projects in the magnitude of both time and cost overruns. This difference, 25.1% worse mean time overrun, 51.2% worse mean cost overrun, and 100% versus 75% budget exceedance rate, is due to differences in the procurement, payment, and site assessment processes of road projects rather than differences in contractor capability.

Fourth, the five top-ranked barriers to efficiency in construction delivery, such as, adequate planning, number of reworks, payment delays, cost control systems and information coordination, are all administrative and informational management failures rather than technical or site constraints. This is noteworthy because this is the type of construction management failure most directly and conveniently subject to digital intervention.

Fifth, the Digital Intervention Framework (DIF) proposed in this paper offers a context-specific mapping of each of the five most influential efficiency factors to digital tools tailored for the Nigerian small construction firms, from low-infrastructure interventions (mobile payment systems, digital scheduling apps) available today, to medium-infrastructure interventions (cloud-based CDEs, BIM cost management) that can be developed under a planned digital maturity development strategy.

Study Limitation

The study is limited to archival data (52 projects) and the questionnaire sample (n = 29) is drawn exclusively from Ondo State, thereby restricting direct generalisation to other Nigerian states or Sub-Saharan African contexts with different procurement environments, contractor profiles, or public-sector payment practices. Also, the archival records were sourced from contracting firms, consulting firms, and government ministries and may not capture projects for which records were incomplete or unavailable, introducing a potential availability bias in the performance data.

Recommendations

For construction contractors, poor planning is the major efficiency bottleneck, and digital projects with realistic, detailed, resource-loaded plans are more efficient than projects planned by hand. Microsoft Project is a low-cost option.

For construction clients, especially government agencies with road infrastructure projects, implement digital payment platforms that facilitate interim payment within the specified contract timeframe. The fact that all of the road projects in the study were over the contract sum suggests that payment delay is contributing to cost overruns in a way that contractor effectiveness cannot overcome.

For quantity surveying companies: use digital cost management software to track costs in real-time. The 12.78% mean cost overrun in building projects and 19.33% in road projects are both failures of cost monitoring, which can be substantially mitigated by real-time cost monitoring tools that alert users to the onset of cost overruns.

For professional associations (NIQS, NIOB, NSE) and government: design and implement a digital construction literacy program for Ondo State construction practitioners, including BIM basics, digital project management and e-procurement. The digital tools that tackle the five highest-ranked efficiency constraints are off-the-shelf and affordable the problem is a lack of skills and awareness.

For future research: the archival data set of 52 completed projects included in this study is a welcome addition to the evidence base on the performance of

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the Nigerian construction industry, but is limited to one state. A replication study across multiple states, using archival project records and data on firms' digital tool adoption, measuring whether firms that have adopted specific digital tools demonstrate systematically better cost and time performance compared to firms that have not, would generate the causal evidence needed to link digital adoption to cost and time performance.

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