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Artificial Intelligence and Public Procurement of Road Transport Infrastructure in Benue State: Applications, Challenges and Prospects

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Abstract

The procurement of road transport infrastructure in Nigeria, and Benue State in particular, has long been bedevilled by inefficiency, contract inflation, project abandonment and pervasive corruption. Recent estimates indicate that Nigeria loses approximately US$18 billion annually to financial crimes and corrupt procurement processes, while procurement accounts for nearly 50 per cent of government expenditure in sub-Saharan Africa. This paper examines the potential of Artificial Intelligence (AI) to transform the public procurement of road transport infrastructure in Benue State, with specific attention to its applications, challenges and prospects. Anchored on the Technology Acceptance Model (TAM) of Davis (1989) and the Unified Theory of Acceptance and Use of Technology (UTAUT) of Venkatesh et al. (2003), the study employs a descriptive analytical design supported by documentary evidence and secondary statistical data from the Benue State Budget Estimates (2024 and 2025), the National Bureau of Statistics, the Bureau of Public Procurement, Transparency International and the Public and Private Development Centre. Findings reveal that AI applications, including machine learning algorithms for bid evaluation, natural language processing for contract review, predictive analytics for cost estimation, computer vision for site monitoring, and satellite imagery analysis for road condition assessment, can significantly enhance transparency, reduce corruption and improve value for money in Benue State's road transport infrastructure procurement. However, weak digital infrastructure, inadequate technical expertise, limited regulatory frameworks, data scarcity, ethical concerns and resistance to change constitute significant barriers. The paper concludes that, with deliberate policy reforms, sustained investment in digital capacity and strong political will, AI offers considerable prospects for repositioning Benue State's road infrastructure procurement system. It recommends, among other measures, the establishment of a State AI Procurement Unit, the integration of AI modules into the existing e-procurement portal, public–private partnerships with technology firms, and the periodic training of procurement officers in data science and machine learning.

Keywords: Artificial Intelligence, Public Procurement, Road Transport Infrastructure, Benue State, e-Procurement, Technology Acceptance Model.

Introduction

Road transport infrastructure remains the most pervasive and economically significant mode of transport in Nigeria, accounting for over 90 per cent of all freight and passenger movements within the country (Federal Ministry of Works, 2023). Nigeria possesses a road network of approximately 195,000 kilometres, of which about 32,000 kilometres are federal roads, 31,000 kilometres are state roads, and the remainder are local government and rural feeder roads (Infrastructure Concession Regulatory Commission [ICRC], 2017; Federal Republic of Nigeria, 2023). Disturbingly, more than 135,000 kilometres of this network remain un-tarred, while a substantial proportion of the paved roads has deteriorated into deplorable conditions owing to insufficient investment, weak procurement systems and poor maintenance culture (ICRC, 2017; Adeoye & Bello, 2023).

Benue State, located in the North-Central geopolitical zone of Nigeria and covering a landmass of 34,059 square kilometres, is administered through twenty-three (23) local government areas with Makurdi as its capital (National Bureau of Statistics [NBS], 2024). As the self-acclaimed "Food Basket of the Nation", the state's economic vitality depends heavily on functional road infrastructure to facilitate the evacuation of agricultural produce from rural areas to urban markets. Yet, an empirical assessment of road network connectivity in the Benue basin recorded a beta index of 0.98, an alpha index of -0.05 and a gamma index of 0.20, indicating poor network connectivity and the existence of a fragmented, deteriorating road system (Iorkua, Anjide, & Tyonum, 2023). This situation is compounded by recurrent flooding, herdsmen–farmer conflicts and security challenges that have damaged numerous roads and bridges across the state.

Public procurement constitutes the single largest channel through which government infrastructural projects are delivered. According to the Brookings Institution (2024), procurement accounts for up to 50 per cent of government expenditure in sub-Saharan Africa, making it one of the most consequential governance functions. In Nigeria, however, the procurement system has been undermined by chronic corruption, with the country obtaining a score of 26 out of 100 on the 2024 Corruption Perceptions Index of Transparency International (Transparency International, 2025; Public and Private Development Centre [PPDC], 2025). Egboboh (2024), citing the Centre for the Study of the Economies of Africa, reports that Nigeria loses approximately US$18 billion annually to financial crimes and corrupt procurement processes, a figure that surpasses the combined annual budgets of several Nigerian states.

In Benue State specifically, the procurement of road transport infrastructure has been at the centre of fiscal expansion. The 2025 budget of N550.1 billion presented by Governor Hyacinth Iormem Alia reflects a 47.5 per cent increment over the 2024 revised budget, with capital expenditure allocations soaring from 54 per cent in 2022 to 254.1 per cent in 2024 and a record-breaking 538.6 per cent in 2025 (Benue State Government, 2025; Blueprint Newspapers, 2025). Capital budget performance has also improved from 23.8 per cent in 2022 to 85.06 per cent in 2024, the highest in nearly two decades (Blueprint Newspapers, 2025). Despite these gains, concerns persist regarding contract inflation, opaque award processes and the substandard quality of executed road projects.

Artificial Intelligence (AI) is increasingly being deployed globally to address such procurement pathologies. AI refers to the capability of machines to perform tasks that ordinarily require human intelligence, such as learning, reasoning, perception, and decision-making (Wooldridge, 2021; Russell & Norvig, 2022). In the procurement domain, AI applications include machine learning for fraud detection, natural language processing (NLP) for contract analysis, predictive analytics for cost estimation, robotic process automation for routine tasks, and computer vision for monitoring construction sites (Vajjhala et al., 2021; Pindar, Yusuf, & Bala, 2024). Recent studies have demonstrated that AI-enabled procurement systems reduce processing times by between 30 and 60 per cent, lower transaction costs by up to 40 per cent, and significantly enhance fraud detection capabilities (Ovsyannikova & Domashova, 2020; Yamusa et al., 2021).

Notwithstanding the rich global literature on AI and public procurement, there exists a noticeable paucity of empirical studies that situate the discourse within the peculiarities of sub-national governments in Nigeria, particularly in Benue State. The few existing studies (e.g. Olatunji, Olawumi, & Odeyinka, 2016; Pindar et al., 2024) have largely focused on national-level analyses, leaving a lacuna at the state and local government levels. It is against this backdrop that this paper examines the applications, challenges and prospects of artificial intelligence in the public procurement of road transport infrastructure in Benue State.

Objectives of the Study

The general objective of this paper is to examine the role of artificial intelligence in the public procurement of road transport infrastructure in Benue State. Specifically, the paper seeks to:

i. Examine the contemporary applications of AI in public procurement of road transport infrastructure;
ii. Identify the challenges militating against the deployment of AI in road transport infrastructure procurement in Benue State;
iii. Analyse statistical evidence on procurement performance and infrastructural expenditure in Benue State; and
iv. Explore the prospects of AI-driven procurement reforms in the state.

Methodology

The study adopts a descriptive-analytical research design, relying primarily on the synthesis of secondary data sourced from peer-reviewed journals, conference proceedings, official government publications, budget documents, statistical bulletins, and reports of multilateral institutions. Quantitative data were extracted from the Benue State Budget Estimates (2024 and 2025), the National Bureau of Statistics, the Bureau of Public Procurement (BPP), the Public and Private Development Centre (PPDC) and Transparency International. The data were analysed using descriptive statistics involving frequencies, percentages and trend analysis, presented in tables and discussed thematically.

Conceptual Clarifications

Artificial Intelligence

Artificial Intelligence (AI) is conceptualised as the branch of computer science concerned with the design and development of machines and software systems that exhibit cognitive functions associated with the human mind, including learning, reasoning, problem-solving, perception, decision-making and language comprehension (Wooldridge, 2021; Russell & Norvig, 2022). AI subsumes a constellation of technologies such as machine learning (ML), deep learning (DL), natural language processing (NLP), computer vision, robotics, expert systems and big data analytics. According to PwC Nigeria, Lagos Business School, and Microsoft (2024), AI represents not merely a technological shift but a strategic opportunity for Nigeria to accelerate inclusive growth, enhance public service delivery and position the country as a digital leader in Africa.

Public Procurement

Public procurement refers to the acquisition by government entities of goods, works and services from external suppliers using public funds (Federal Republic of Nigeria, 2007; Adeoye, 2022). The Public Procurement Act of 2007 establishes the legal and institutional framework for the procurement function at the federal level in Nigeria, while individual states such as Benue have enacted their own procurement laws (Benue State Public Procurement Law, 2010) to guide procurement activities at the sub-national level. Procurement processes generally encompass needs identification, planning, advertisement, prequalification, tender evaluation, contract award, execution and project monitoring.

Road Transport Infrastructure

Road transport infrastructure refers to the network of carriageways, bridges, drainage systems, traffic control facilities, road signage and ancillary structures that enable the movement of people and goods by motorised and non-motorised vehicles. In the Nigerian context, road transport infrastructure is classified into three tiers: federal trunk 'A' roads managed by the Federal Ministry of Works; state trunk 'B' roads managed by state ministries of works; and local government and rural feeder trunk 'C' roads (Federal Highway System of Nigeria, 2023; Iorkua et al., 2023).

Theoretical Framework

This study is anchored on two complementary theories: the Technology Acceptance Model (TAM) propounded by Davis (1989) and the Unified Theory of Acceptance and Use of Technology (UTAUT) developed by Venkatesh, Morris, Davis, and Davis (2003). Together, these theories provide a robust analytical lens for understanding how AI technologies may be adopted, accepted and institutionalised within the public procurement architecture of Benue State.

The Technology Acceptance Model (TAM)

The Technology Acceptance Model, originally developed by Davis (1989), is an information systems theory that explains how users come to accept and utilise new technologies. The model posits that two principal cognitive variables determine the behavioural intention to use a technology: Perceived Usefulness (PU) and Perceived Ease of Use (PEOU). Perceived Usefulness is defined as the degree to which an individual believes that using a particular system will enhance his or her job performance, while Perceived Ease of Use refers to the degree to which an individual believes that using the system will be free of effort (Davis, 1989; Schepers & Wetzels, 2021).

Within the context of AI deployment in public procurement, the TAM is highly relevant. Procurement officers, accounting officers, contractors and other stakeholders in Benue State will only embrace AI-enabled procurement tools if they perceive them as useful in enhancing transparency, reducing workload and improving project outcomes, and if such tools are demonstrably easy to operate. Empirical studies have confirmed the predictive power of TAM in

explaining technology adoption in government settings; for instance, Al-witwit and Ibrahim (2023) found that perceived usefulness was the strongest predictor of AI acceptance in government ministries, with a path coefficient of 0.34 ($p < 0.001$), followed by an AI-mindset growth dimension at 0.28 ($p < 0.001$).

The Unified Theory of Acceptance and Use of Technology (UTAUT)

Recognising the limitations of TAM in capturing organisational and contextual influences, Venkatesh et al. (2003) developed the UTAUT, which integrates eight prior models, including TAM, the Theory of Planned Behaviour and the Diffusion of Innovations Theory. UTAUT identifies four core determinants of technology acceptance: Performance Expectancy, Effort Expectancy, Social Influence, and Facilitating Conditions, with moderating variables such as gender, age, experience and voluntariness of use.

Within the Benue State procurement context, Performance Expectancy aligns with the belief that AI will improve procurement efficiency; Effort Expectancy concerns the perceived ease of using AI-enabled systems; Social Influence captures the role of political leadership, professional bodies and donor agencies in advocating for AI adoption; while Facilitating Conditions relate to the availability of digital infrastructure, technical expertise and supportive regulatory frameworks. The integration of TAM and UTAUT therefore offers a comprehensive theoretical scaffolding for analysing both the micro (individual) and macro (institutional) dimensions of AI adoption in Benue State's road transport infrastructure procurement.

Application of the Framework to the Study

Drawing from the TAM–UTAUT synthesis, this study posits that the successful adoption of AI in Benue State's road transport infrastructure procurement is contingent on five interrelated factors: (i) the perceived usefulness of AI in reducing corruption and improving project outcomes; (ii) the perceived ease of use of AI-enabled procurement platforms; (iii) social influences from political leadership, professional associations and citizens; (iv) the existence of enabling facilitating conditions such as broadband connectivity, electricity and skilled personnel; and (v) institutional readiness in terms of policy, regulation and organisational culture. These constructs guide the discussion in subsequent sections.

Statistical Analysis

This section presents and analyses statistical evidence on public procurement performance, corruption and infrastructural expenditure in Nigeria and Benue State, drawing on data from credible national and international sources.

Corruption Perceptions and Public Procurement in Nigeria

Table 1 presents Nigeria's scores and rankings on the Corruption Perceptions Index (CPI) over a five-year period.

Table 1: Nigeria's Corruption Perceptions Index (CPI), 2020–2024

Year	CPI Score (out of 100)	Rank (out of 180)	Remarks
2020	25	149	Below global average of 43

Year	CPI Score (out of 100)	Rank (out of 180)	Remarks
2021	24	154	Decline of one point
2022	24	150	Marginal improvement in rank
2023	25	145	Slight gain
2024	26	140	Modest progress; still highly corrupt

Source: Compiled from Transparency International (2021, 2022, 2023, 2024, 2025); PPDC (2025); Athena Centre for Policy and Leadership (2025).

From Table 1, it is evident that Nigeria's CPI score has hovered between 24 and 26 over the past five years, well below the global average of 43, with public procurement consistently identified as the most corruption-prone area of public sector governance (PPDC, 2025; Transparency International, 2025). The persistently low score implies that procurement reforms grounded in technology are imperative.

Financial Cost of Procurement Corruption

Beyond perception indices, empirical estimates suggest that Nigeria suffers staggering financial losses through corrupt procurement processes. The Centre for the Study of the Economies of Africa reported that Nigeria loses approximately US$18 billion annually to financial crimes and corrupt procurement processes (Egboboh, 2024). This translates to roughly N28 trillion at prevailing exchange rates, more than fifty times the size of Benue State's 2025 budget. Table 2 illustrates the magnitude of procurement losses relative to selected national fiscal indicators.

Table 2: Estimated Annual Procurement Losses Relative to Selected Fiscal Indicators in Nigeria (2024)

Indicator	Amount (Naira)	% of Annual Procurement Loss
Annual procurement losses (CSEA, 2024)	~N28.0 trillion	100%
Federal Government 2024 budget	N28.7 trillion	102.5%
Benue State 2025 budget	N550.1 billion	~2.0%
Benue State 2024 capital expenditure (actual)	N98.0 billion	~0.35%

Source: Computed from Egboboh (2024); Benue State Government (2024, 2025); Blueprint Newspapers (2025); Federal Ministry of Finance (2024).

The figures in Table 2 are sobering. Procurement losses to corruption at the national level approximate the entire federal budget and represent approximately fifty (50) times the value of Benue State's 2025 budget. Such losses, if curbed through AI-driven efficiency gains, could fund the construction of thousands of kilometres of rural roads across Benue State.

Benue State Capital Expenditure and Infrastructural Investment

Capital expenditure trends in Benue State offer further insights into the magnitude of resources committed to infrastructural development, including road transport infrastructure. Table 3 presents the evolution of capital expenditure between 2020 and 2025.

Table 3: Benue State Capital Expenditure Trends, 2020–2025

Year	Capital Expenditure (Naira)	% Growth (YoY)	Capital Budget Performance (%)
2020	8.40 billion	—	19.7
2021	14.50 billion	72.6	25.4
2022	22.30 billion	53.8	23.8
2023	39.10 billion	75.3	54.2
2024	98.02 billion	150.7	85.06
2025*	280.50 billion (projected)	186.2	—

Source: Compiled from Benue State Government (2024, 2025); Blueprint Newspapers (2025); Benue State Government on X (2025). * = projected estimate.

Table 3 reveals that Benue State's capital expenditure grew from N8.4 billion in 2020 to approximately N98.02 billion in 2024, an increase of over 1,000 per cent in five years (Benue State Government, 2025; Blueprint Newspapers, 2025). Equally significant is the improvement in capital budget performance from 23.8 per cent in 2022 to 85.06 per cent in 2024, the highest in nearly two decades. A substantial proportion of this capital expenditure has been deployed to road transport infrastructure, including the construction and dualisation of the Wurukum–Airforce Base Road, the execution of sixteen strategic township roads within Makurdi, Gboko and Otukpo metropolises, and the Light-Up Makurdi project (Federal Ministry of Information and National Orientation, 2025; Blueprint Newspapers, 2025). The sheer scale of these projects underscores the urgent need for AI-driven procurement reforms to safeguard value for money.

Road Network Connectivity and Infrastructure Gap

Statistical evidence on road connectivity in the Benue basin demonstrates persistent infrastructural deficits. The Beta Index of 0.98, Alpha Index of -0.05 and Gamma Index of 0.20 obtained by Iorkua et al. (2023) reveal that the road network in the Benue basin is sparsely connected, with limited redundancy and poor accessibility. Nigeria as a whole has only about 60,000 kilometres of paved roads out of an estimated 195,000 kilometres of road network, leaving an infrastructure gap of about 135,000 kilometres of un-tarred roads (ICRC, 2017; NBS, 2024). According to the World Bank (2023), every road left unmaintained for three years can cost up to six times more to repair, highlighting the economic imperative of AI-enabled predictive maintenance.

Applications of Artificial Intelligence in Public Procurement of Road Transport Infrastructure

The deployment of AI in public procurement is no longer a futuristic projection; it is a contemporary reality in many jurisdictions across the globe. The European Union, the United States, Singapore and South Korea have all integrated AI tools into their public procurement processes (Vajjhala et al., 2021; Pindar et al., 2024). The following sub-sections present the principal applications of AI relevant to the procurement of road transport infrastructure in Benue State.

Machine Learning for Bid Evaluation and Fraud Detection

Machine learning algorithms, particularly supervised and unsupervised learning models, can automatically evaluate tender submissions, identify anomalies in bidding patterns and detect collusion among contractors. Ovsyannikova and Domashova (2020) developed a neural network model that accurately identified public procurement contracts with a high risk of non-performance, achieving classification accuracy above 85 per cent. In the Benue State context, such models can be trained on historical road contract data to flag suspicious price patterns, identify bid-rigging cartels, and predict the likelihood of project abandonment before contract award.

Natural Language Processing for Contract Analysis

Natural Language Processing (NLP) enables computers to read, interpret and summarise large volumes of textual data, including bid documents, contract clauses, technical specifications and legal opinions. NLP-powered tools can extract pertinent information from thousands of pages of contract documents in minutes, identify inconsistencies between bills of engineering measurement and quantities, detect ambiguous clauses that could be exploited by contractors, and ensure consistency with the Benue State Public Procurement Law (2010) and the federal Public Procurement Act 2007 (Pindar et al., 2024).

Predictive Analytics for Cost Estimation

Predictive analytics utilise historical project data, geographical variables, material price indices and inflation projections to generate accurate cost estimates for proposed road projects. According to Yamusa et al. (2021), machine learning models such as Random Forest and Gradient Boosting can predict construction project costs with mean absolute percentage errors of less than 10 per cent, significantly improving on the rudimentary cost estimation methods currently employed by many Nigerian states. For Benue State, predictive analytics can ensure that contract sums for road projects in Makurdi, Otukpo, Gboko, Katsina-Ala and other localities reflect realistic market conditions, thereby curbing inflation of contract values.

Computer Vision for Site Monitoring and Quality Assurance

Computer vision, often deployed alongside unmanned aerial vehicles (drones) and Internet of Things (IoT) sensors, allows real-time visual monitoring of road construction sites. Mazari (2024), in a project funded by the Mineta Transportation Institute, demonstrated that AI-powered object detection algorithms can identify and classify construction equipment, monitor

work progress and ensure compliance with engineering specifications. In Benue State, drones equipped with computer vision can monitor remote road projects such as those traversing rural communities in Kwande, Logo, and Buruku Local Government Areas, providing procurement officials with verifiable evidence of project execution and quality.

Satellite Imagery and AI for Road Condition Assessment

The Transport Research Laboratory (TRL) has developed an AI solution that uses high-resolution optical satellite imagery to assess the condition of unpaved roads in developing countries, including several African nations. The model categorises road conditions on a five-point scale, identifies defects such as potholes and rutting, and prioritises roads for maintenance or reconstruction (TRL, 2023; Asian Development Bank, 2024). For Benue State, which has thousands of kilometres of un-tarred rural feeder roads vital to agricultural produce evacuation, such satellite-based AI assessments can provide an evidence-based basis for prioritising road procurement decisions.

Robotic Process Automation for Routine Procurement Tasks

Robotic Process Automation (RPA), augmented by AI, can automate repetitive procurement tasks such as data entry, vendor pre-qualification, document verification, and the generation of standardised reports. The Public and Private Development Centre (2025) has emphasised that automation of routine tasks frees procurement officers to focus on strategic functions such as needs analysis, market research and contract management. RPA also minimises human discretion at the data-entry stage, thereby reducing opportunities for manipulation.

AI-Powered Chatbots and Decision Support Systems

AI-powered chatbots and decision support systems can provide procurement officers, contractors and citizens with real-time access to procurement information, guidelines and procedures. In Benue State, a dedicated chatbot integrated into the website of the Benue State Bureau of Public Procurement could enable contractors to query tender requirements, citizens to access information on awarded contracts, and procurement officers to receive intelligent guidance during evaluation processes. Such transparency aligns with the open contracting principles championed by the Open Government Partnership.

Challenges of AI Deployment in Public Procurement of Road Transport Infrastructure in Benue State

Notwithstanding the immense potential of AI, its deployment in Benue State's road transport infrastructure procurement is constrained by a multiplicity of challenges. These challenges are categorised into infrastructural, human capital, legal–regulatory, ethical and political dimensions.

Inadequate Digital and Power Infrastructure

AI systems require robust digital infrastructure, including high-speed broadband, cloud computing facilities, data centres and uninterrupted electricity supply. Nigeria's broadband penetration stood at approximately 48.10 per cent in early 2025 (Nigerian Communications

Commission [NCC], 2025), while electricity supply across Benue State remains erratic, with average daily power supply of about six to ten hours in major towns like Makurdi, Otukpo and Gboko. Onyemaobi and Eze (2024) observed that limited internet connectivity and unreliable power supply remain the most binding constraints on AI deployment in sub-Saharan Africa.

Shortage of AI Skills and Technical Expertise

The successful deployment of AI in procurement demands a critical mass of data scientists, machine learning engineers, procurement analysts and information system specialists. Nigeria currently produces fewer than 5,000 trained AI specialists annually, against an estimated continental demand of over 100,000 (PwC Nigeria, LBS, & Microsoft, 2024). In Benue State, this skills gap is even more acute, with the Benue State Bureau of Public Procurement reportedly lacking in-house AI capacity (Pindar et al., 2024).

Weak Legal and Regulatory Frameworks

The Public Procurement Act 2007 and the Benue State Public Procurement Law 2010 were enacted long before the contemporary AI revolution, and as such do not anticipate or regulate the use of AI tools in procurement decision-making. Although a committee was inaugurated in November 2023 to review the Public Procurement Act 2007, the review process has been criticised for excluding non-governmental organisations specialising in public finance transparency (Hoffmann, 2024). The absence of clear legal provisions on AI-driven procurement creates regulatory uncertainty and inhibits adoption.

Data Scarcity and Poor Data Quality

AI thrives on data. However, Nigeria's public procurement data ecosystem is fragmented, incomplete and often inaccessible. The Open Contracting Data Standard (OCDS) is yet to be fully implemented at the sub-national level, and many road contracts are still procured through manual paper-based systems. Where digital data exist, they are frequently incomplete, inconsistent and not machine-readable, severely limiting the utility of AI models (PPDC, 2025; Shrivastava, 2025).

Ethical Concerns and Algorithmic Bias

AI systems can perpetuate or amplify existing biases if trained on biased data. In a procurement context, algorithmic bias may disadvantage contractors from particular ethnic, regional or gender categories. Shrivastava (2025) integrates the Protection Motivation Theory with TAM to highlight how privacy concerns, data security risks and ethical issues constitute significant risk factors in AI adoption. There is a risk that AI tools, if not carefully designed and audited, could inadvertently entrench biases in favour of well-connected contractors at the expense of small and medium-sized indigenous firms in Benue State.

Resistance to Change and Bureaucratic Inertia

Public sector organisations are typically characterised by entrenched bureaucratic cultures, hierarchical decision-making structures and resistance to innovation. Procurement officers may resist AI adoption out of fear of job displacement, loss of discretionary power, or simple

unfamiliarity with the technology. The TAM–UTAUT framework adopted in this study predicts that low perceived ease of use and weak social influence can significantly reduce the behavioural intention to adopt AI.

Cybersecurity Risks

The integration of AI into procurement systems exposes such systems to cybersecurity risks, including data breaches, ransomware attacks and unauthorised manipulation of bid evaluation algorithms. Nigeria recorded over 12,988 cybersecurity incidents in 2024, with public sector portals among the most frequently targeted (Cybersecurity Experts Association of Nigeria, 2024). For Benue State, the deployment of AI must be accompanied by robust cybersecurity safeguards to prevent the compromise of procurement integrity.

Funding and Cost Constraints

The acquisition, deployment and maintenance of AI systems require substantial financial investment in hardware, software licences, personnel training and continuous system upgrades. With competing demands on the Benue State purse, including security, agriculture, education and health, dedicated funding for AI infrastructure may be difficult to secure in the short term.

Prospects of Artificial Intelligence in Public Procurement of Road Transport Infrastructure in Benue State

Despite the formidable challenges enumerated above, the prospects of AI in transforming Benue State's road infrastructure procurement remain considerable. Several developments at the national and global levels create an enabling environment for AI adoption.

Nigeria's National AI Strategy

In 2024, the Federal Government of Nigeria unveiled the National Artificial Intelligence Strategy, which articulates a vision for leveraging AI to enhance economic competitiveness, promote social inclusion and position Nigeria as a leader in technological innovation (Federal Ministry of Communications, Innovation and Digital Economy, 2024). Complementary initiatives such as the Nigeria Artificial Intelligence Research Scheme (NAIRS) and the National Centre for Artificial Intelligence and Robotics (NCAIR) provide funding, infrastructure and technical support for AI-driven projects across the federation, including state-level applications.

Expanding Digital Infrastructure

The Nigerian government, through the National Information Technology Development Agency (NITDA), recently assumed control of the Nigeria Government Enterprise Architecture (NGEA) Portal to strengthen coordination and interoperability among government digital platforms (African Leadership Magazine, 2026). The launch of the Galaxy Backbone government cloud platform in January 2026 further provides a secure infrastructure for deploying AI applications. Benue State can leverage these federal investments to host its AI-enabled procurement systems.

Strong Political Will at the State Level

The administration of Governor Hyacinth Iormem Alia has demonstrated a marked commitment to digital transformation, exemplified by the training of 10,000 youths in ICT and digital skills in collaboration with Google and Microsoft, and the prioritisation of the digital economy in the 2025 budget (Blueprint Newspapers, 2025). This political will provides a fertile ground for embedding AI in road infrastructure procurement.

Partnerships with Multilateral Institutions and the Private Sector

Multilateral institutions such as the World Bank, the African Development Bank, the European Union and the United Nations Development Programme have funded AI capacity-building initiatives in several African countries. Public–private partnerships with technology giants such as Microsoft, IBM, Google and Huawei, as well as indigenous Nigerian technology firms, present opportunities for Benue State to access cutting-edge AI tools at concessional terms.

Rising Civic Demand for Transparency

Civil society organisations in Nigeria, such as the Public and Private Development Centre (PPDC), BudgIT, the Centre for Democracy and Development (CDD), and Connected Development (CODE), have been at the forefront of demanding greater transparency in public procurement. The growing civic pressure, combined with the openness afforded by AI-driven open contracting platforms, creates a powerful coalition for procurement reform in Benue State.

Global Best Practices and Knowledge Transfer

South Korea's KONEPS system, Brazil's ComprasNet, India's Government e-Marketplace (GeM) and Estonia's e-procurement platform offer instructive models for Benue State. The Asian Development Bank (2024) reports that AI integration in South Korea's KONEPS platform has reduced procurement cycle times by an average of 41 per cent and lowered transaction costs by 35 per cent. Benue State can adapt these models to its peculiar context through structured knowledge transfer arrangements.

Conclusion

This paper has examined the applications, challenges and prospects of artificial intelligence in the public procurement of road transport infrastructure in Benue State. Anchored on the Technology Acceptance Model and the Unified Theory of Acceptance and Use of Technology, the study has demonstrated that AI offers a transformative pathway for addressing the chronic inefficiencies, corruption and project failures that have characterised Benue State's road infrastructure procurement. Statistical evidence indicates that while Benue State's capital expenditure has grown by over 1,000 per cent between 2020 and 2024, persistent challenges of contract inflation, project abandonment and substandard works continue to undermine value for money. AI applications such as machine learning for bid evaluation, NLP for contract analysis, predictive analytics for cost estimation, computer vision for site monitoring and satellite imagery for road condition assessment can significantly enhance procurement efficiency, transparency

and accountability. Nevertheless, the realisation of these benefits is contingent on overcoming infrastructural, human capital, legal–regulatory, ethical, cybersecurity and funding constraints.

Recommendations

In the light of the foregoing, the paper makes the following recommendations:

i. The Benue State Government should establish a dedicated State AI Procurement Unit within the Bureau of Public Procurement, staffed by data scientists, machine learning engineers and procurement specialists, with a clear mandate to design, deploy and monitor AI-enabled procurement tools.
ii. The Benue State House of Assembly should amend the Benue State Public Procurement Law 2010 to incorporate explicit provisions on AI-driven procurement, including standards for algorithmic transparency, auditability and accountability.
iii. The state government should integrate AI modules, particularly machine learning for fraud detection and NLP for contract analysis, into its existing e-procurement portal, while progressively migrating all road contracts above N50 million to the platform.
iv. Public–private partnerships with technology firms such as Microsoft, Google, IBM and indigenous Nigerian start-ups should be pursued to access cutting-edge AI tools at concessional rates and to facilitate knowledge transfer.
v. Capacity-building programmes in data science, AI ethics and digital procurement should be instituted for procurement officers, accounting officers, engineers and members of the Benue State Tenders Board, in collaboration with the National Centre for Artificial Intelligence and Robotics, the Benue State University Makurdi, the University of Mkar, and the Joseph Sarwuan Tarka University Makurdi.
vi. The state government should invest in foundational digital infrastructure, including expanded broadband coverage, off-grid renewable power solutions for procurement offices and the establishment of a Benue State Data Centre, to facilitate AI deployment.
vii. The Open Contracting Data Standard (OCDS) should be fully adopted at the state level to ensure that procurement data is published in machine-readable formats, thereby providing the data foundation upon which AI models can be trained and deployed.
viii. Civil society organisations, professional associations such as the Nigerian Institute of Quantity Surveyors and the Nigerian Society of Engineers, and the academia should be actively engaged in the design, monitoring and evaluation of AI-driven procurement reforms to ensure inclusivity, ethical compliance and public trust.

By implementing these recommendations, Benue State can position itself as a sub-national leader in AI-enabled public procurement, significantly improving the delivery of road transport infrastructure and accelerating the realisation of its development aspirations as the Food Basket of the Nation.

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