ISSN:2584-2706 DOI: https://doi.org/10.5281/zenodo.22797256

Professional Relevance in the AI ERA: Smart Contracts, Ethical AI, and Safety-Centric Project Delivery in Nigeria

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Abstract

The emergence of Built Environment 5.0 marks a paradigm shift from automation to human-centric, AI-augmented, and sustainable project delivery. Within this era, two persistent challenges in the construction industry remain unresolved: contractual disputes arising from poor administration and high rates of occupational accidents due to reactive safety management. Artificial Intelligence (AI) offers transformative potential to address both through smart contracts for automated compliance and AI-driven systems for predictive safety. However, technological adoption without professional readiness risks ethical breaches, job displacement, and poor governance. This paper examines how built environment professionals in Nigeria can maintain relevance by leveraging AI in contract management and safety-centric delivery. Using a mixed-method design, data were collected from 150 built environment professionals and 5 key informants in Imo, Lagos, and FCT. Findings indicate that AI and smart contracts significantly improve transparency, reduce disputes, and accelerate payment cycles with a mean rating of 4.18. AI tools for computer vision and predictive analytics were also found to enhance hazard identification and PPE compliance, with a mean of 4.33. The study further revealed three critical competencies for professional relevance: AI literacy, data ethics, and human oversight. Anchored on the Technology Acceptance Model and Theory of Responsible Innovation, the paper argues that professional relevance in the AI era is not about competing with machines, but about governing them ethically. The study recommends curriculum reform, policy mandates for AI in public projects, and the development of a Nigerian Built Environment AI Ethics Code. It concludes that the future professional will be an "AI-Augmented Decision Steward" who uses technology to deliver safer, sustainable, and legally resilient infrastructure. The paper contributes to discourse on digital transformation, professional development, and sustainable development goal 8, 9, and 11 in the African context.

Keywords: Artificial Intelligence, Smart Contracts, Construction Safety, Ethical AI, Nigeria,

1.0 Introduction.

The built environment contributes approximately 13% to global GDP and employs over 7% of the world's working population (McKinsey, 2020). Yet it remains one of the least digitized sectors and has the highest rate of fatalities and disputes. The Fourth Industrial Revolution, and now the Fifth, is forcing a redefinition of how we design, contract, and construct. "Built Environment 5.0" refers to a human-

ISSN:2584-2706 DOI: https://doi.org/10.5281/zenodo.22797256

centered, resilient, and sustainable ecosystem where AI, IoT, digital twins, and block chain augment human decision-making (Sacks et al., 2020). Two areas where this is most urgent are:
1.Contract Management: Traditional paper-based contracts are prone to ambiguity, delays, and litigation. Globally, 48% of projects experience disputes, with an average resolution time of 15 months (Arcadis, 2023).
2. Construction Safety: Construction accounts for 1 in 5 worker fatalities globally (ILO, 2023). Most incidents are predictable but occur due to human error and poor monitoring.
AI presents a dual solution. Smart contracts can self-execute payments and flag deviations. AI-powered computer vision can detect unsafe acts in real time. However, technology alone is insufficient. The central question for Nigeria and other developing economies is: Will our professionals lead this change or be displaced by it? This paper therefore argues that professional relevance in the AI era will be defined by the capacity to ethically govern AI tools for smarter contracts and safer sites.

2.0 Background to the Study.

Nigeria's construction industry contributes 4.1% to GDP but is plagued by abandonment, cost overrun averaging 40%, and poor safety records (NBS, 2024). At independence in 1960, Nigeria inherited functional institutions. However, incremental improvement has been slow.
Globally, firms like Turner, Skanska, and Julius Berger are deploying AI. Procore uses AI to analyze RFIs and change orders. OpenSpace AI creates 360-site documentation to resolve claims. In safety, Guardhat and http://Smartvid.io use computer vision to detect PPE violations. In Nigeria, adoption is still at less than 15% (Oke et al., 2023). Barriers include poor digital infrastructure, low AI literacy, and absence of regulatory frameworks. Professional bodies such as COREN, NIQS, NIA, and NIOB have begun CPD on BIM, but little on AI ethics or smart contracts. If Nigeria is to achieve the Renewed Hope Infrastructure Agenda and SDG 9, professionals must transition from "document administrators" to "AI-Augmented Decision Stewards." This study is therefore timely.

3.0 Aim and Objectives.

Aim: To examine the role of AI in enhancing professional relevance through smart contract management and safety-centric project delivery in the Nigerian built environment.
Specific Objectives:
1.To evaluate the application of AI and smart contracts in improving contract administration and reducing disputes in construction projects.
2. To assess the impact of AI-driven tools on safety performance and hazard prevention on construction sites.
3. To identify ethical considerations and competencies required for built environment professionals to remain relevant in the AI era.

4.0 Literature Review and Theoretical Framework.

4.1 Conceptual Review.

Smart Contracts: These are self-executing contracts with terms written in code, deployed on blockchain (Alaloul et al., 2021). AI enhances them by using NLP to review thousands of contract clauses and flag risks. Benefits include automation, transparency, and reduced disputes (Liu et al., 2022).
AI for Safety: AI uses computer vision, wearables, and predictive analytics. It can detect falls, equipment misuse, and worker fatigue (Fang et al., 2020). This shifts safety from "after-the-fact reporting" to "before-the-fact prevention." Ethical AI: Concerns include algorithmic bias, data privacy, job loss, and accountability (Jobin et al., 2019). Professionals must ensure AI aligns with human values.

4.2 Theoretical Framework.

This study is anchored on two theories:
1. Technology Acceptance Model (TAM) by Davis (1989): Professionals will adopt AI if they perceive it as useful and easy to use. This explains adoption barriers in Nigeria.
2. Theory of Responsible Innovation (RI) by Stilgoe et al. (2013): Innovation must be anticipatory, reflexive, inclusive, and responsive. This frames the ethical dimension of AI in construction.

ISSN:2584-2706 DOI: https://doi.org/10.5281/zenodo.22797256

5.0 Research Gap.
Extant literature has extensively covered AI in design optimization and scheduling. However, there is a dearth of studies that:
1. Link AI in contract administration directly to safety outcomes.
2. Address professional competence and ethics in the African context.
3. Provide empirical data from developing economies on AI adoption barriers.
This study fills this gap by providing Nigeria-specific data and a framework for professional development.

6.0 Pulation and Sample Selection.
This section explains how the population was defined and how the sample for this study was selected.

6.1 Study Population.
The target population for this study comprised *registered built environment professionals* practicing in Nigeria, specifically in *Lagos State, FCT Abuja, and Imo State*.
These 3 states were chosen because they represent:
1. Lagos - Commercial hub with the highest concentration of large-scale construction projects
2. FCT Abuja - Administrative capital with major government infrastructure projects
3. Imo State - Representing the South-East zone with emerging urban development

Population Frame:
The population frame was drawn from the official membership registers of 4 professional bodies as at December 2025:

Professional Body	Lagos	FCT Abuja	Imo State	Total
Nigerian Institute of Architects NIA	420	310	85	815
Council for the Regulation of Engineering COREN	580	450	120	1,150
Nigerian Institute of Quantity Surveyors NIQS	380	290	95	765
Nigerian Institute of Building NIOB	350	260	110	720
Total Population N	1,730	1,310	410	3,450

Source: Membership Secretariat of NIA, COREN, NIQS, NIOB, 2026

Inclusion Criteria:
Only professionals with minimum of 1-year post-registration experience and currently involved in active construction projects were included.

6.2 Sample Size Determination.
The sample size was determined using *Taro Yamane's formula* for finite population:
n = \frac{N}{1 + N(e)^2}
Where:
n = Sample size
N = Population size = 3,450
e = Level of precision = 0.08 at 92% confidence level
n = \frac{3450}{1 + 3450(0.08)^2} = \frac{3450}{1 + 22.08} = \frac{3450}{23.08} = 149.48
Approximated Sample Size = 150 respondents

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An additional 10% was added to account for non-response. However, 150 was maintained because the response rate was high.

6.3 Sampling Technique

A 2-stage sampling technique was adopted:

Stage 1: Stratified Sampling

The total population was stratified by state and by profession to ensure representation. Proportional allocation was used:

Table: Sample Allocation by State and Profession.

Profession	Lagos 50%	FCT 38%	Imo 12%	Total
Architect	15	11	4	30
Engineer	19	14	5	38
Quantity Surveyor	17	13	4	34
Builder	15	11	4	30
Project Manager	9	7	2	18
Total	75	56	19	150

Stage 2: Purposive and Snowball Sampling.

Within each stratum, respondents were selected purposively based on:

1. Active involvement in contract administration OR site management in the last 12 months
2. Willingness to participate

Snowball sampling was then used where initial respondents referred other eligible professionals in their network.

6.4 Sample for Qualitative Data.

For the in-depth interviews, 5 key informants were selected using purposive sampling based on:

1. Minimum 15 years' experience
2. Fellowship status in their professional body
3. Experience with digital tools/AI on projects

Breakdown: 1 Senior Architect, 1 COREN Fellow Engineer, 1 NIQS Fellow QS, 1 Builder, 1 HSE Project Manager.

6.5 Justification.

This sampling approach ensures:

1. Representativeness: All major built environment professions and the 3 geopolitical zones covered are represented
2. Relevance: Only professionals with direct experience in contracts and safety were selected

3.Generalizability: With n=150 and 94.6% response rate, findings can be generalized to built environment professionals in urban Nigeria.

A total of 142 valid questionnaires were retrieved, giving a response rate of 94.6%, which is above the 70% threshold recommended by Babbie (2020) for survey research.

7.0 Methodology.

ISSN:2584-2706 DOI: https://doi.org/10.5281/zenodo.22797256

Research Design: Mixed method - convergent parallel design.
Study Area: Lagos, FCT Abuja, and Imo State, representing commercial, administrative, and emerging construction hubs.
Population: 3,450 registered professionals in NIA, NIQS, NIOB, COREN.
Sample Size: 150 questionnaires + 5 in-depth interviews. Determined using Taro Yamane formula.
Sampling Technique: Purposive and snowball sampling.
Instrument: Structured questionnaire with 5-point Likert scale. Cronbach's Alpha = 0.84. Interview guide for senior practitioners.
Method of Data Analysis: SPSS v26 for descriptive statistics, Pearson correlation. Thematic analysis for qualitative data.

8.0 Data Analysis, Results and Discussion

Study: Professional Relevance in the AI Era: Smart Contracts, Ethical AI, and Safety-Centric Project Delivery.

8.1 Data Analysis and Results.

A total of 150 questionnaires were distributed and 142 were retrieved, giving a response rate of 94.6%. 5 key informant interviews were also conducted.

8.2 Demographic Characteristics of Respondents

Variable	Category	Frequency	Percentage %
Gender	Male	87	61.3
	Female	55	38.7
Profession	Architect	28	19.7
	Engineer	36	25.4
	Quantity Surveyor	34	23.9
	Builder	24	16.9
	Project Manager	20	14.1
Years of Experience	1-5 years	31	21.8
	6-10 years	42	29.6
	11-15 years	33	23.2
	16 years and above	36	25.4

Source: Obasa, 2026.
Interpretation: Majority of respondents were male with 6-15 years' experience, indicating that the data reflects views of mid-career professionals actively involved in project delivery.

Objective 1: To evaluate the application of AI and smart contracts in improving contract administration and reducing disputes.
Respondents were asked to rate statements on a 5-point Likert scale: 1=Strongly Disagree, 5=Strongly Agree. Decision rule: Mean ≥ 3.50 = Agreed.

Table 1: AI and Smart Contracts in Contract Administration.

S/N	Statement	Mean	Std. Deviation	Decision
1	AI can automatically detect ambiguities and errors in contract documents	4.32	0.61	Agreed
2	Smart contracts improve transparency in payment certification and valuation	4.18	0.72	Agreed

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3	AI reduces the incidence of claims, variations and litigation	4.05	0.68	Agreed
4	Blockchain-based smart contracts will reduce project delays	3.96	0.79	Agreed
5	AI can audit BOQs and flag discrepancies faster than manual methods	4.21	0.65	Agreed
Grand Mean		4.14	0.69	Agreed

Source: Obasa, 2026.

Discussion of Objective 1.

The grand mean of 4.14 indicates strong agreement that AI and smart contracts can improve contract administration. The highest rated item was AI's ability to detect ambiguities in contracts with a mean of 4.32. This suggests professionals see AI as a tool for risk mitigation at the pre-contract stage.

This finding aligns with Liu et al. (2022) who reported that NLP-powered contract review reduced disputes by 25%. During interviews, a Quantity Surveyor with 20 years' experience stated:

"If we had AI to check BOQs and variations, we would avoid most of the claims that delay projects in Nigeria."

This implies that the professional role is shifting from manual checking to AI governance and validation. Smart contracts were also seen as critical for payment transparency, which is a major challenge in Nigerian public projects.

Objective 2: To assess the impact of AI-driven tools on safety performance and hazard prevention on construction sites.

Table 2: Impact of AI on Construction Safety Performance.

S/N	Statement	Mean	Std. Deviation	Decision
1	AI-powered computer vision improves real-time hazard identification	4.40	0.55	Agreed
2	Wearables and AI can predict worker fatigue and prevent accidents	4.21	0.67	Agreed
3	AI monitoring increases compliance to PPE use on site	4.27	0.63	Agreed
4	Linking safety KPIs to contracts via AI reduces site accidents	3.98	0.81	Agreed
5	AI helps in generating accurate safety reports for decision making	4.15	0.70	Agreed
Grand Mean		4.20	0.67	Agreed

Source: Obasa, 2026.

Correlation Analysis

Pearson correlation was run between "Level of AI Adoption" and "Perceived Safety Improvement".

`r = 0.67, p < 0.01`

This shows a strong positive and significant relationship. As AI adoption increases, perceived safety performance also increases.

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Discussion of Objective 2.
With a grand mean of 4.20, respondents strongly agree that AI improves safety outcomes. The highest mean of 4.40 was for real-time hazard identification using computer vision. This supports Fang et al. (2020) who found computer vision reduced safety incidents by 30%.
A key theme from interviews was the integration of safety and contract. One Project Manager noted: "When safety becomes a KPI in a smart contract and payment depends on it, contractors will take it seriously."
This shows AI can bridge the gap between commercial objectives and HSE objectives. The correlation result further confirms that investment in AI tools will likely yield measurable safety improvements.

Objective 3: To identify ethical considerations and competencies required for built environment professionals to remain relevant in the AI era.
Data for this objective was analyzed qualitatively from 5 key informant interviews and quantitatively from 4 Likert-scale items.

Table 3: Ethical Competencies for Professional Relevance.

S/N	Statement	Mean	Std. Deviation	Decision
1	Professionals need AI literacy to interpret and validate AI outputs	4.35	0.58	Agreed
2	Data privacy and ethics must guide use of worker data from AI tools	4.28	0.64	Agreed
3	Human oversight is still required; professionals should not fully rely on AI	4.41	0.52	Agreed
4	Lack of training is the biggest barrier to AI adoption in Nigeria	4.19	0.71	Agreed
Grand Mean		4.31	0.61	Agreed

Source: Obasa, 2026.
Thematic Analysis from Interviews.
Three major themes emerged:
1. AI Literacy: All 5 respondents stated that professionals must understand how AI works to avoid "blind trust."
2. Data Ethics & Privacy: 4/5 respondents raised concerns about misuse of data collected from wearables and site cameras.
3. Human Oversight and Accountability: All respondents agreed that the professional must remain the final decision-maker. AI is a tool, not a replacement.

Discussion of Objective 3.
The grand mean of 4.31 shows that ethical competence is critical for relevance. This aligns with the Theory of Responsible Innovation (Stilgoe et al., 2013) which emphasizes anticipation and reflexivity. The biggest barrier identified was lack of training with a mean of 4.19. This confirms the Technology Acceptance Model (Davis, 1989) - without perceived ease of use and training, adoption will be low. The implication is that professional bodies must move beyond software training to include AI ethics, data governance, and critical thinking in their CPD programs.

8.3 Summary of Findings
1. AI and smart contracts are perceived to significantly improve contract transparency, reduce disputes, and accelerate payments. Grand Mean = 4.14.

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2. AI-driven tools have a strong positive impact on safety performance, especially in hazard detection and PPE compliance. Grand Mean = 4.20. There is a significant correlation r=0.67 between AI adoption and safety.
3. Professional relevance in the AI era depends on three competencies: AI Literacy, Data Ethics, and Human Oversight. Lack of training is the major barrier. Grand Mean = 4.31.

8.4 Stimulating Awareness: The Future Professional.

Built Environment 5.0 will not eliminate professionals. It will eliminate professionals who refuse to evolve. The future QS will audit smart contracts, not just measure. The future Engineer will train AI to detect structural defects. The future Architect will use generative AI but apply ethical judgment on community impact. As Nelson Mandela improved on what he inherited, so must we. We inherited manual processes. Our mandate is to leave behind intelligent, safe, and ethical systems.

9.0 Conclusion

This study concludes that AI is central to professional relevance in Built Environment 5.0. Smart contracts can reduce disputes and improve transparency. AI can transform construction safety from reactive to predictive. However, technology without ethics is dangerous. Nigerian professionals must urgently acquire AI literacy and ethical competence to lead rather than follow.

10.0 Recommendations

1. For Professional Bodies: Mandate AI, Data Ethics, and Smart Contract modules in COREN, NIQS, and NIA CPD within 12 months.
2. For Government: Through BPP, mandate e-procurement and AI-based safety monitoring for all federal projects above N1 billion.
3. For Academia: Universities should embed “AI for Construction” and “Construction Law & Smart Contracts” in undergraduate curricula.
4. For Industry: Firms should establish an “Ethical AI Charter” and appoint a Chief AI Ethics Officer.
5. For Policy: The Federal Ministry of Works should develop a Nigerian Built Environment AI Ethics and Governance Framework.

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