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AN INVESTIGATION OF INNOVATION IN CONSTRUCTION FIRMS IN KATSINA STATE-NIGERIA: THE PROFESSIONALS' PERSPECTIVE

Yakubu Kabir*[1], Abubakar Mohammad[2] and Dahiru Tukur Bakiyawa[3]

[1&2]Department of Building Technology, Hassan Usman Katsina Polytechnic Katsina, Nigeria.

[3]Department of Quantity Surveying, Hassan Usman Katsina Polytechnic Katsina, Nigeria.

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***Corresponding Author: Yakubu Kabir**
Department of Building Technology, Hassan Usman Katsina Polytechnic Katsina, Nigeria.

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ABSTRACT

Innovation in construction firms refers to the adoption and application of new ideas, technologies, processes, and business approaches that improve the planning, execution, and management of construction projects. Despite the significant contribution of the construction industry to economic development, the industry has been widely criticized for its relatively low level of innovation, which has contributed to poor productivity, cost overruns, quality challenges, and reduced competitiveness. Conversely, innovation has been recognized as a key driver of improved organisational performance, enhanced productivity, better client satisfaction, and sustainable business growth. This study aimed to assess the innovation practices and benefits of innovation among construction firms in Katsina State, Nigeria, from the perspective of construction professionals. The study adopted a quantitative survey research design. Data were collected using a structured questionnaire and analysed using frequency, percentage, mean score, and standard deviation. The findings revealed that product (technology), process, and marketing innovation practices among construction firms in Katsina State are practiced at an occasional level, with overall Mean Item Scores (MIS) of 2.64 (SD = 1.30), 3.19 (SD = 1.25), and 3.40 (SD = 1.26), respectively. Among the product and technology innovations, the use of Building Information Modeling (BIM), Internet of Things (IoT), and Virtual Reality (VR)/Augmented Reality (AR) ranked highest, with MIS values of 3.05 (SD = 1.19), 2.99 (SD = 1.34), and 2.83 (SD = 1.29), respectively. Similarly, Life Cycle Costing (LCC), Public–Private Partnerships (PPPs), and Integrated Project

Delivery (IPD) emerged as the leading process innovation practices, with MIS values of 3.43 (SD = 1.25), 3.36 (SD = 1.39), and 3.20 (SD = 1.24), respectively. The leading marketing innovation practices included the use of project signboards, business networking, and proposal writing to attract clients, with MIS values of 3.92 (SD = 1.11), 3.77 (SD = 1.06), and 3.74 (SD = 1.19), respectively. The study further revealed that the most important benefits of innovation to construction firms in Katsina State include gaining professional experience, improving client satisfaction, and ensuring business sustainability, with MIS values of 4.27 (SD = 0.94), 4.23 (SD = 0.99), and 4.20 (SD = 0.95), respectively. The study concludes that although construction firms in Katsina State have embraced innovation to some extent, the level of adoption remains moderate, indicating considerable potential for improvement. It is therefore recommended that construction firms increase the adoption of innovative technologies, processes, and marketing practices to maximize the benefits of innovation, improve organisational performance, enhance competitiveness, and promote sustainable growth within the construction industry.

KEYWORDS: Innovation, Construction Firms, Innovation Practices, Benefits of Innovation, Katsina State.

1.1 INTRODUCTION

According to Wei and Lam (2014), Noktehdan et al. (2015), Tajuddin et al. (2015), Davis et al. (2016), Ezeokoli et al. (2016), Owusu-Manu et al. (2017), and Owolabi et al. (2019), the construction industry is one of the driving forces of the economy in many countries that significantly contributes to economic growth and social development through the transformation of various resources into constructed facilities. This entails planning, design, construction, maintenance, repair, and operation of infrastructural facilities by different stakeholders including contractors, construction professionals, public and private clients, and material manufacturers. The industry contributes between 5–10% of gross domestic product (GDP) and accounts for the majority of fixed capital formation in many countries (Meng & Brown, 2018). Wei and Lam (2014) described the construction industry as a principal economic driver contributing about 15% of the GDP of the United Kingdom, while Tajuddin et al. (2015) portrayed it as an "essential growth enabler" because of its extensive linkages with manufacturing and other sectors. Davis et al. (2016) further reported that the industry enhances quality of life through the provision of essential infrastructure. In Nigeria, the construction industry contributes approximately 4.13% of the nation's real GDP, promotes

social progress through employment generation, and provides infrastructure necessary for the efficient functioning of society (Owolabi et al., 2019).

Construction has been defined as a series of activities undertaken to produce, modify, or alter buildings and infrastructure (AbdulAzeez et al., 2015). These activities include infrastructure development, building construction, repairs, maintenance, and demolition, all of which are executed by construction firms (Myers, 2013). Construction firms are registered organizations that undertake construction projects by providing the required skills, expertise, and resources in exchange for financial reward (Ibrahim et al., 2014; Chukwudi & Tobechukwu, 2014; Mafimidiwo & Iyagba, 2015; Ogunde et al., 2016). They include both contracting firms responsible for physical construction works and consultancy firms responsible for design, supervision, and project management (Inuwa et al., 2015; Ogbu, 2011; Odediran et al., 2012; Kado, Garba, & Dodo, 2015).

Construction firms occupy a significant position in the Nigerian construction industry and constitute the backbone of project delivery (Ibrahim, 2014; Ibrahim, Githae, & Stephen, 2014; Mafimidiwo & Iyagba, 2015; Ogunde et al., 2016). Tajuddin et al. (2015) argued that the contribution of the construction industry to national development is closely associated with the level of innovation adopted by organisations within the industry.

Innovation has increasingly become a critical factor for improving organisational performance in the construction industry. Several scholars have identified innovation as a major determinant of productivity, profitability, competitiveness, quality improvement, cost reduction, client satisfaction, and organisational sustainability (Abiola-Falemu, Ogunsemi, & Oyediran, 2010; Moohammad, Yusof, & Kamal, 2014; Wei & Lam, 2014; Ozorhon, Oral, & Demirkesen, 2015; Meng & Brown, 2018). Innovation also improves productivity (Noktehdan, Shahbazpour, & Wilkinson, 2015; Davis, Gajendran, Vaughan, & Owi, 2016; Kamal, Yusof, & Iranmanesh, 2016; Gledson & Phoenix, 2017), enhances profitability and business expansion (Wei & Lam, 2014; Abdu & Jibir, 2017; Gledson & Phoenix, 2017), strengthens competitive advantage (Wei & Lam, 2014; Kamal, Yusof, & Iranmanesh, 2016; YuSheng & Ibrahim, 2020), improves quality and client satisfaction while reducing project duration and costs (Xiaolong, Ruixue, Rebecca, & Jason, 2014; Kamal, Yusof, & Iranmanesh, 2016), enhances corporate image (Wei & Lam, 2014; Xiaolong, Ruixue, Rebecca, & Jason, 2014), promotes organisational survival (Abiola-Falemu, Ogunsemi, & Oyediran, 2010; Moohammad, Yusof, & Kamal, 2014), and drives long-term growth and sustainability (Gledson & Phoenix, 2017; John, Shakantu, & Olaku, 2019; YuSheng & Ibrahim, 2020).

However, despite the acknowledged importance of innovation, innovation practices among construction firms in Katsina State have not been adequately investigated. This gap provides the motivation for examining the innovation practices adopted by construction firms and assessing the benefits derived from innovation in the study area.

1.2 Statement of the Research Problem

Despite the important role of the construction industry in economic growth and infrastructure development, the industry has continued to experience criticism for its low level of innovation and weak innovation performance compared with other sectors of the economy (Wei & Lam, 2014; Meng & Brown, 2018). Xiaolong, Ruixue, Rebecca, and Jason (2014) observed that the construction industry is widely recognized for its conservatism and limited innovative capacity, while Tajuddin, Iberahim, and Ismail (2015) reported that the industry records one of the lowest innovation performances among major industries. Similarly, Liu, Skibniewski, and Wang (2016) noted that innovation performance in construction remains relatively poor, and Kamal, Yusof, and Iranmanesh (2016) found that many construction firms suffer from inadequate innovation practices.

In Nigeria, the situation is not significantly different, as construction industry operators, including consultants and contractors, have been reported to show low disposition towards the adoption of innovation (Moohammad, Yusof, & Kamal, 2014). The persistence of traditional methods, limited technological adoption, and inadequate innovative practices are believed to contribute to several performance challenges within the industry. These challenges include low productivity, poor profitability, inadequate quality, cost and time overruns, and unsatisfactory client outcomes (Abiola-Falemu, Ogunsemi, & Oyediran, 2010; Liu, Skibniewski, & Wang, 2016; Shelton, Martek, & Chen, 2016; Meng & Brown, 2018; Owolabi et al., 2019).

Paradoxically, existing literature has consistently emphasized that innovation offers numerous benefits to construction organisations. Innovation has been associated with improved productivity (Noktehdan, Shahbazpour, & Wilkinson, 2015; Davis, Gajendran, Vaughan, & Owi, 2016), enhanced profitability and business expansion (Wei & Lam, 2014; Abdu & Jibir, 2017), stronger competitive advantage (Wei & Lam, 2014; YuSheng & Ibrahim, 2020), improved quality and client satisfaction, reduced project duration and costs (Xiaolong, Ruixue, Rebecca, & Jason, 2014; Kamal, Yusof, & Iranmanesh, 2016), and long-term organisational survival and growth (Abiola-Falemu, Ogunsemi, & Oyediran, 2010; Gledson & Phoenix, 2017; John, Shakantu, & Olaku, 2019).

Although these benefits are well documented, there is limited empirical evidence regarding the actual innovation practices adopted by construction firms in Katsina State and the extent to which firms perceive and experience the benefits of innovation within their operations. Most previous studies have focused on broader national or international contexts, with little attention given to the specific circumstances of construction firms operating in Katsina State. Consequently, there is insufficient understanding of whether construction firms in the state are actively engaging in innovative practices and whether such practices are translating into measurable organisational benefits.

This gap in knowledge creates uncertainty for policymakers, industry stakeholders, and firm managers seeking to promote innovation and improve construction performance in the state. Therefore, this study seeks to examine the innovation practices among construction firms in Katsina State and determine the benefits derived from innovation by these firms, thereby providing empirical evidence that can support efforts to strengthen innovation and enhance the performance of the construction industry in the study area.

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1.3 Aim and Objectives

The aim of this research is to assess innovation among construction firms in Katsina State.

The objectives of the research are:

1. To examine the innovation practices among construction firms in Katsina
2. To determine the benefits of innovation to construction firms in Katsina
3. To assess the level of innovation adoption among construction firms in Katsina State.

2.0 LITERATURE REVIEW

2.1 Construction Firms

Construction refers to the process of producing, modifying, repairing, or maintaining buildings and infrastructure through a series of organized activities (AbdulAzeez et al., 2015; Hamilton, 2006). These activities are undertaken by construction firms, which are legally registered organizations responsible for executing construction projects and delivering infrastructure that supports economic and social development (Ogbu, 2011; Ibrahim, 2014; Mudi, Bioku, & Kolawole, 2015; Ogunde et al., 2016; Kehinde & Simon-Ilogho, 2023). Construction firms play a vital role in project delivery and serve as the primary agents through which innovation is introduced and implemented in the construction industry.

Construction firms are broadly classified into contracting firms and consulting firms (Ogbu, 2011; Odediran et al., 2012; Myers, 2013; Ibrahim, 2014; Lu et al., 2014; Mudi et al., 2015;

Abba, Hussaini, & Mohammed, 2022; Kehinde & Simon-Ilogho, 2023). Contracting firms are responsible for the physical execution of construction works by mobilizing labour, materials, equipment, and financial resources to complete projects efficiently and profitably (Ibrahim, 2014; Lu et al., 2014; Mudi et al., 2015; Ogunde et al., 2016). Consulting firms, on the other hand, provide professional services such as planning, design, supervision, and project management through qualified professionals including architects, engineers, builders, quantity surveyors, and town planners (Kado, Garba, & Dodo, 2015; Ezeokoli et al., 2016; Abba, Hussaini, & Mohammed, 2022; Suleiman, Shika, Dahiru, & Abdulrazaq, 2023).

Both contracting and consulting firms are central to the adoption and implementation of innovation in the construction industry. Their organizational structure, technical expertise, and professional capabilities determine the extent to which innovative practices are embraced and translated into improved project performance. Consequently, assessing innovation practices among these firms and the benefits derived from innovation is essential for enhancing productivity, quality, competitiveness, and overall organisational performance in the construction industry.

2.2 Innovation in Construction Firms

From organisational perspective, there exists consensus among scholars that the widely recognised definitions of innovation in construction context are the Rogers' and Slaughter's definitions (Moohammad *et al*., 2014; Xiaolong *et al*., 2014; Liu *et al*., 2016; Shelton *et al*., 2016; Gledson & Phoenix, 2017). Rogers (1995; 2003) defined innovation as "an idea, practice or object that is new by an individual or other unit of adoption"; Slaughter (1998; 2000) defined innovation as the application or actual use of a nontrivial change and improvement to an organization's processes, products, or systems which is novel to the institution developing the change or organization utilizing the change. Following Rogers's and Slaughter's definitions, Moohammad *et al.* (2014) defined organization innovation as "the generation and application of new ideas, practices or non-trivial change and improvement to an organization's processes/methods, products/technology or systems of operation aimed at improving performance". In the same vein, Damanpour (1992) also defined innovation as "the adoption of an idea or behaviour, whether a system, policy, program, device, process, product or service, that is new to the adopting organisation"

2.3 Innovation Practices in Construction Firms

According to Moohammad *et al.* (2014), the need for innovation practices in organisations has been recognized as a vital process for the survival of organizations in the current globalized economy characterized by intense competition, perfect market information system.

Owusu-Manu *et al.* (2017) reported that it is very essential and increasingly important for construction firms to adopt and implement particular innovation practices, concepts and techniques in order to remain competitive in the industry, sustain growth and sustainability, and that innovation practices have become the engine for driving the successful completion of projects. Researchers like Tangkar and Arditi (2000), Moohammad *et al.* (2014), Noktehdan *et al*. (2015), Davis *et al.* (2016), Brockmann *et al.* (2016), Gledson and Phoenix (2017), Nnaji *et al.* (2017), Meng and Brown (2018), Noktehdan *et al.* (2019), John *et al.* (2019) and YuSheng and Ibrahim (2020) all reported that innovation practices in construction organisations could be grouped into product innovation, process innovation and marketing innovation. These are discussed in the subsequent subsections:

2.3.1 Product Innovation

Moohammad, Yusof and Kamal (2014) and Nnaji, Gambatese, Awolusi and Oyeyipo (2017) refers this category of innovation as the technology innovation such as mechanisation, automation and use of information technology. According to Tangkar and Arditi (2000), the technology-driven school of thought is rooted in Schumpeter's ideas, and places the major role of innovation creation on technology; and in the context of construction, innovation practice can be considered as the use of technology within a construction firm. Similarly, Gledson and Phoenix (2017) reported that Murphy *et al.* (2015) defined product innovation as new or improved commercially available technology designed for permanent incorporation within the works and introduced to meet the needs of the market. Davis, Gajendran, Vaughan and Owi (2016) reported that Technological innovation involves the utilization of technical approaches. Tajuddin, Iberahim and Ismail (2015) states that Information Technology (IT) innovation is characterized by the adoption of hardware and software that are used to facilitate for a more effective and efficient construction project implementation. Such innovative technologies were identified by Lu, et al. (2024) and Dagou, Gurgun, Koc and Budayan (2025) to include: Building Information Modeling (BIM), Artificial Intelligence (AI) and machine learning (ML), Robots, unmanned aerial vehicles (UAV) or drones, Internet of Things (IoT), virtual reality (VR) and augmented reality (AR), Digital Twin technology and blockchain technology.

2.3.2 Process Innovation

Process innovation has to with application of new or improved production process/delivery methods (e.g. improvements in construction methods) and management approach to improve production and management process of construction projects delivery (Tangkar & Arditi, 2000; Moohammad, Yusof, & Kamal, 2014; Gledson & Phoenix, 2017); these can include

but not limited to: Prefabrication and modular construction methods (Unegbu, Yawas, Dan-asabe, & Alabi, 2024; Dagou, Gurgun, Koc, & Budayan, 2025), Lean construction practices e.g. Just-in-Time (JIT), Last Planner System (LPS), Value Stream Mapping (VSM), Continuous Improvement (Kaizen), Total Productive Maintenance (TPM), 5S (Sort, Straighten, Shine, Standardise, and Sustain), Root Cause Analysis, Team Preparation, Concurrent Engineering, Total Quality Management (TQM), Value Management, Visual Management, Supply Chain Management (SCM) (Bajjou, Chafi, & Ennadi, 2019; Yaro, Adamu, Saidu, & Anifowose, 2024a; 2024b; Obodoh, Onwuliri, Umeokana, & Makuochukwu, 2025; Obodoh, Okeke, Mgbeahuru, & Okongwu, 2025) and Lifecycle Costing (Tajuddin, Iberahim, & Ismail, 2015)

2.3.2 Marketing Innovation

Marketing innovation covers innovative marketing activities and ideas relating to market research, promotion, pricing, advertising, packaging, positioning, differentiation, distribution etc. that help promote market success of product and services (Tangkar & Arditi, 2000; Moohammad *et al*., 2014; YuSheng & Ibrahim, 2020). Ogbu (2015) identified marketing strategies of Quantity Surveying consultancy firms in Nigeria, the strategies were grouped into marketing management strategies and tactical strategies.

The marketing management strategies relates to operational marketing policy or philosophy including marketing research, market segmentation, marketing mix, relational marketing, marketing plan, affinity/partnership marketing, alliance marketing, product differentiation, environmental scanning, dynamic project screening, analysis of strategic priorities, selling the benefits not the features. While, the marketing tactical strategies were further divided into people/organisational strategies, promotion and education strategies and price and other user outlay strategies. The people/organisational strategies lay emphasis on the parties coming together for business: the clients and firms, these includes project co-development strategy (partnership between client and consultant), customer call centre/customer feedback mechanisms, development of none-economic or social bonds, conflict management, maintaining a strong pool of professionals to boost company image, connection with other businesses, transactional marketing, professional contract, greater communication with clients, networking investments, customisation of projects to suit clients, packaging of company documents to look attractive, use of information technology (ICT) in service delivery to make company more appealing, location of firm closer to clients, writing of proposals to attract clients. The promotion and education strategies aim at communicating the existence, important features and benefits of the firm’s brand to (prospective) clients, these

include being listed in business directories (yellow pages), development of a marketable name, use of promotional products (e.g. gifts given to clients for their patronage), equipment branding, business promotion, sponsorships of events in the area of operation, corporate social responsibility, charitable initiatives, social marketing (using standard marketing practices to achieve social good), use of print media advertisements, broadcast media, call to action marketing (CTA marketing), company web-sites, project signboard. The price and other user outlay strategies focus on client attraction or retention through price inducements and product quality by improving service quality at constant price or reducing price at constant quality, these include free design contribution, inclusion of 'political' offers in bids, financial and none financial rewards, after sales service, claim aversion, location of firm closer to clients, maintaining a good track record, Optimal pricing, improvement in service performance, offer of seasonal gifts to clients, granting of credits/flexible payment options.

According to Mochtar and Arditi (2001), pricing is one of the most important aspects of marketing in construction transactions and contracting that mostly takes place in the bidding process. These authors identified cost-based and market-based pricing as the pricing strategies used in construction. The cost-based pricing involves estimating the project cost, then applying a mark-up for profit; in this approach, detailed project cost estimating tasks are performed independently of market data collection, and company executives make their decisions to bid or not to bid based on their capabilities and internal needs rather than on market information. In other words, once the estimating function is set in motion, the project is bid regardless of the market information collected. While, the market-based pricing involves bidding project fully based on collected market information through marketing intelligence with cost analysis and adjustments being performed only after winning the project, before the construction phase begins.

Furthermore, Oladimeji and Aina (2018) reported bid pricing strategies of contractors in Nigeria including bidding almost at no profit/reducing the cost of project almost at no profit in a bid to win a contract, overpricing bid items that will be used in greater quantities than estimated in the proposal and under-pricing items that will be used in significantly lesser quantities, overbilling preliminary items/increasing unit rates of preliminary items, overpricing work done early in the project, distribution of contract mark-ups on cost items based on the contractors' retainage and pay-when-paid clause, and unbalance distribution of contract mark-ups by increasing mark-ups of items of work at the stages of project.

2.4 Benefits of Innovation to Construction Firms

Wei and Lam (2014) reported that the benefits of innovation were postulated as the enormous gains and savings that can be harvested from innovation. According to Owusu-Manu *et al.* (2017), better understanding of the expected benefits of innovation can help an organisation make an informed decision in relation to innovation adoption. Ozorhon *et al*. (2015) distinguished the benefits of innovation into project-level benefits and firm/corporate-level benefits; project-level benefits are associated with project performance, whereas, firm-level benefits are the wider benefits that can be realized in the long run. Furthermore, project-level benefits are assumed to affect the extent of firm-level benefits. Based on the information gathered in the literature, the benefits of innovation to construction firms are presented in the table below:

Table 2.1: Benefits of Innovation to Construction Firms.

S/No.	Benefit	Source(s)
1.	Sustainability	Gambatese and Hallowell (2011); Owusu-Manu *et al*. (2017); Xiaolong *et al.* (2014)
2.	Provide competitive advantage	Gambatese and Hallowell (2011); Owusu-Manu *et al*. (2017); Liu *et al.* (2016); Abiola-Falemu *et al*. (2010); YuSheng and Ibrahim, (2020)
3.	Improve company/corporate image	Owusu-Manu *et al*. (2017); Wei and Lam, (2014); Xiaolong *et al.* (2014); Ozorhon *et al.* (2015)
4.	Improve corporate/organisational performance	Owusu-Manu *et al*. (2017); Wei and Lam, (2014); Xiaolong *et al.* (2014); Ozorhon *et al.* (2015)
5.	Increase in market share/market growth	Gambatese and Hallowell (2011); Owusu-Manu *et al*. (2017); YuSheng and Ibrahim, (2020)
6.	Improve short- and long-term profitability	Gambatese and Hallowell (2011); Owusu-Manu *et al*. (2017); Ozorhon *et al.* (2015)
7.	Increase productivity	Liu *et al.* (2016); Xiaolong *et al.* (2014); Gledson and Phoenix (2017)
8.	Intellectual property (patents, trademarks, designs)	Gambatese and Hallowell (2011); Owusu-Manu *et al*. (2017); Ozorhon *et al.* (2015)
9.	Improve technical capability and managerial capabilities	Gambatese and Hallowell (2011); Owusu-Manu *et al*. (2017); Ozorhon *et al.* (2015)
10.	Gaining experience	Ozorhon *et al.* (2015)
11.	Enhance Quality of Construction Output	Gambatese and Hallowell (2011); Owusu-Manu *et al*. (2017); Xiaolong *et al.* (2014)
12.	Improve client satisfaction	(Gambatese and Hallowell (2011); Owusu-Manu *et al*. (2017)
13.	Improve human resources	Gambatese and Hallowell (2011); Owusu-Manu *et al*. (2017)
14.	Increase worker safety	Xiaolong *et al.* (2014)
15.	Future business collaborations	Ozorhon *et al.* (2015)

Source: Literature NB: This list is not exhaustive

3.0 RESEARCH METHODOLOGY

This study adopted a quantitative survey research design to assess the innovation practices and benefits of innovation among construction firms in Katsina State, Nigeria. The quantitative approach was considered appropriate because it enables the collection and statistical analysis of numerical data, while the survey design facilitates the collection of information from a representative sample of construction professionals (Creswell, 2003; 2013; Saunders et al., 2009; Gledson & Phoenix, 2017). The target population comprised 715 registered construction professionals, including architects, builders, engineers, quantity surveyors, land surveyors, town planners, and estate surveyors practicing in Katsina State. Using the Yamane (1967) formula at a 90% confidence level and 10% margin of error, a sample size of 88 was obtained, which was increased by 30% to 114 respondents to account for non-response. The sample was proportionately allocated across the professional groups using Bowley's (1926) proportional allocation method, while purposive sampling was employed to select respondents with adequate knowledge and experience relevant to the study (Ilori et al., 2018; Kumar, 2011; Tichapondwa, 2013).

Primary data were collected through a structured questionnaire developed from relevant literature on innovation in construction firms (Shokri-Ghasabeh & Chileshe, 2016; Kamal et al., 2016; Ezeokoli et al., 2016; Owusu-Manu et al., 2017; Owolabi et al., 2019). For this study, the questionnaire focused on respondents' demographic characteristics, innovation practices, and the benefits of innovation, with responses measured on a five-point Likert scale. The collected data were analysed using Microsoft Excel, employing descriptive statistical tools including frequency, percentage, Mean Item Score (MIS), and Standard Deviation (SD). Frequency and percentage were used to describe respondents' characteristics, while MIS and SD were used to determine the extent of innovation practices and rank the perceived benefits of innovation among construction firms in Katsina State (Holt, 2014; Samuel & Eziyi, 2014; Ezeokoli et al., 2016).

4.0 RESULTS AND DISCUSSIONS

4.1 Questionnaire Response Rate

A total of Eighty-four valid responses were received, representing 73.7% response rate. This response rate was deemed adequate and acceptable for the study, beacause the response rate is relatively high (73.7%) as compared to similar studies relating innovation in construction firms by Wei and Lam (2014) (5.51%), Ozorhon *et al.* (2015) (33%), Kamal *et al.* (2016) (12.1%), Meng and Brown (2018) (22.9%), Duodu and Rowlinson (2021) (17%), hence, this

validates representativeness of the sample of study. Furthermore, Moser and Kalton (1971) also stated that the result of a survey could be considered as biased and of little value if the response was lower than 30-40%, the response rate for this research is 73.7% which indicate an unbiased and higher value of the survey. Table 4.1 shows details of the response rate.

Table 4.1: Questionnaire Response Rate.

Questionnaire	Frequency	Percentage (%)
No. of responses received	84	73.7
Non-responses accounted	30	26.3
Total	**114**	**100.0**

Source: Field Survey, 2026

4.2 Demography of the Respondents

Table 4.2 shows the respondents' professional affiliation: 7 (8.33%) were Architects, 19 (22.62%) were Builders, 14 (16.67%) were Civil Engineers, 9 (10.71%) were Electrical Engineers, 2 (2.38%) were Estate Surveyors, 3 (3.57%) were Land Surveyors, 5 (5.96%) were Mechanical Engineers, 16 (19.05%) were Quantity Surveyors and 9 (10.71%) were Town Planners. Also, all the respondents were registered with relevant professional bodies: 14 (16.67%) were non-corporate members, 65 (77.38%) were corporate members and 5 (5.95%) were fellow members. These ensures that all the professionals in Katsina State were fairly represented in the survey as the study to seek to get the professionals' perceptions on the subject matter and the diverse background of the respondents as attested ensures the reliability, quality and validity of the responses gathered.

Results on educational qualification of the respondents in table 4.2 depict that 26 (30.95%) of the respondents possess Masters Degree, 23 (27.38%) possess Post Graduate Diploma, another 23 (27.38%) possess First Degree, 9 (10.71%) posess Higher National Diploma and 3 (3.57%) possess Doctorate Degree. Overall, all the respondents hold at least Higher National Diploma/Bachelor's Degree. This shows that the repondents are highly educated.

Result on the type of construction firm the repondents are working in the table 4.2, shows that out of the total number of 84 respondents 58 (69.04%) are working with both consulting and contracting firms, 13 (15.4.8%) are working with consulting firm and another 13 (15.4.8%) are working with contracting firm. All the respondents in the survey were drawn from either one (1) of the three (3) construction firms. This ensures an equal representation as well as an all-encompassing view on the subject matter.

Furthermore, table 4.2 displayed the respondents' years of work experience, 13 (15.48%) of the respondents have between 0 and 5 years, 26 (30.95%) have between 6 and 10 years of experience, 19 (22.62%) have between 11 and 15 years of experience, 13 (15.48%) have between 16 and 20 years of experience while, 3 (3.57%) of the respondents have between 21 and 25 years of experience, 7 (8.33%) have between 26 and 30 years of experience and 3 (3.57%) have above 30 years of experience. Overall, (84.52%) of the respondents have at least six (6) years of experience showing the maturity level of the respondents. This is indicative of the adequate practical experience and exposure of the respondents and also reflective that the respondents have sufficient knowledge and are very likely to understand and accurately interpret the questionnaire items leading to the quality responses.

Table 4.2: Demography of the Respondents.

Characteristics	**Classification**	**Frequency**	**Percentage (%)**
Professional Affiliation	Architecture	7	8.33
	Building	19	22.62
	Civil Engineering	14	16.67
	Electrical Engineering	9	10.71
	Estate Surveying	2	2.38
	Land Surveying	3	3.57
	Mechanical Engineering	5	5.96
	Quantity Surveying	16	19.05
	Town Planning	9	10.71
Total		**84**	**100.0**
Membership Type	Non-corporate	14	16.67
	Corporate	65	77.38
	Fellow	5	5.95
Total		**84**	**100.0**
Educational Qualification	Higher National Diploma	9	10.71
	Post Graduate Diploma	23	27.38
	First Degree	23	27.38
	Master Degree	26	30.95
	Doctorate Degree	3	3.57
Total		**84**	**100.0**
Firm Type	Consulting	13	15.48
	Contracting	13	15.48
	Both Consulting and Contracting	58	69.04
Total		**84**	**100.0**
Professional Working	0 – 5 years	13	15.48
	6 – 10 years	26	30.95
	11 – 15 years	19	22.62
	16 – 20 years	13	15.48

Experience	21 – 25 years	3	3.57
	26 – 30 years	7	8.33
	Above 30 years	3	3.57
Total		**84**	**100.0**

Source: Field Survey, 2026

4.3 Innovation Practices

Three (3) groups of innovation practices in construction firms were identified i.e. product (technology), process (improved methods used in construction delivery) and marketing (ideas and activities to promote market success of products and services) innovations with 8, 5 and 22 practices respectively, totaling 35 practices. These practices were presented in tabular form and the respondents were asked to indicate the extent of usage of these practices in construction firms in Katsina State built on a five point frequency scale; 1 "Never" (i.e. no use) indicating not use at all, 2 "Rarely" (i.e. little use) indicating low usage, 3 "Sometimes" (i.e. moderate use) indicating occassional usage, 4 "Often" (i.e. frequent use) indicating high usage and 5 "Always" (i.e. extensive use) indicating very high usage. Table 4.3 shows the result of innovation practices in construction firms in Katsina State based on the perception of professionals. An overall group mean and standard deviation of **2.64 (SD = 1.30), 3.19 (SD = 1.25), 3.40 (SD = 1.26)** were recorded for the entire product (technology), process and marketing innovations respectively which when each of the group mean approximated to **3.0** translate to "Sometimes" indicating that innovation practices among construction firms in Katsina State is occassional.

Likewise, from table 4.3, it can be seen that out of 8 product (technology) innovation practices identified, the top three leading practices were: "use of Building Information Modeling (BIM) to develop precise data-driven models (e.g. traditional 3D digital representations, time (4D), cost (5D), and sustainability (6D)) to streamline planning and decision-making; facilitate real-time collaboration among stakeholders; and optimize lifecycle of a building" with MIS of 3.05 (SD = 1.19), followed by "use of Internet of Things (IoT) (e.g. smart sensors, actuators and wearable devices) for real-time data collection, monitoring and controlling of energy consumption, air quality, and water usage in buildings; real-time monitoring of worker health and environmental conditions" with MIS of 2.99 (SD = 1.34) and then "use of Virtual Reality (VR) and Augmented Reality (AR) to redefine project or design visualization and improve stakeholder engagement" with MIS of 2.83 (SD = 1.29). Similarly, out of 5 process innovation practices identified, the top three leading practices were: "use of lifecycle costing method to determining total cost of project over its entire

lifespan covering acquisition/project initiation, operation, maintenance and disposal costs" with MIS of 3.43 (SD = 1.25), followed by "use of Public Private Partnerships (PPPs) where partnership is created between public and private entities allowing each side to benefit from a project" with MIS of 3.36 (SD = 1.39) and then "use of Integrated Project Delivery (IPD) method – a team-based approach to design and construction that emphasizes collaboration and sharing risks and rewards of the project's success between all the stakeholders throughout the life of the project" with MIS of 3.20 (SD = 1.24). Moreover, out of 22 marketing innovation practices identified, the top three leading practices were: "use of project signboard" with MIS of 3.92 (SD = 1.11), followed by "connection with other businesses" with MIS of 3.77 (SD = 1.06), and then "writing proposals to attract clients" with MIS of 3.74 (SD = 1.19).

Table 4.3: Innovation Practices of Construction Firms in Katsina State.

S/N	Practices	Frequency					∑F	∑FX	Mean	SD	Rank
		1	2	3	4	5					
1.	Use of Building Information Modeling (BIM) to develop precise data-driven models (e.g. traditional 3D digital representations, time (4D), cost (5D), and sustainability (6D)) to streamline planning and decision-making; facilitate real-time collaboration among stakeholders; and optimize lifecycle of a building	16	26	23	16	13	84	256	3.05	1.19	1st
2.	Use of Artificial Intelligence (AI) and Machine Learning (ML) to refine decision-making; optimize workflows; offer predictive insights to identify and manage risks, and allocate resources more effectively	16	33	13	19	3	84	212	2.52	1.15	4th
3.	Use of Robots and automation to perform repetitive and high-risk tasks e.g. inspection, surveillance, cleaning and maintenance	36	16	10	19	3	84	189	2.25	1.32	8th
4.	Use of Drones or Unmanned Aerial Vehicles (UAV) in site surveying, monitoring, and inspection	38	10	3	23	10	84	209	2.49	1.56	6th
5.	Use of Internet of Things (IoT) (e.g. smart sensors, actuators and wearable devices) for real-time data collection, monitoring and controlling of energy consumption, air quality, and water usage in buildings; real-time monitoring of worker health and environmental conditions	10	29	13	16	16	84	251	2.99	1.34	2nd
6.	Use of Virtual Reality (VR) and Augmented Reality (AR) to redefine project or design visualization and improve stakeholder engagement	16	23	10	29	6	84	238	2.83	1.29	3rd

7. Use of Digital Twin Technology to create virtual replica of a physical building or virtual representation of the construction project that can be used for real-time monitoring of construction progress, simulation, and analysis	19	30	13	19	3	84	209	2.49	1.18	5th
8. Use of Blockchain technology to enhance contract transparency and accountability, and prevent fraud	23	32	6	13	10	84	207	2.46	1.36	7th
Average Mean								**2.64**	**1.30**	
Process Innovation (Improved Methods Used in Construction Delivery)										
9. Use of prefabrication or modular construction methods where building components are manufactured off-site and then later assembled on site	6	29	26	13	10	84	244	2.90	1.13	5th
10. Use of lean construction techniques to streamline construction process, reduce waste, increase value and encourage continuous improvement throughout the project's lifecycle	10	19	26	16	13	84	255	3.04	1.24	4th
11. Use of lifecycle costing method to determining total cost of project over its entire lifespan covering acquisition/project initiation, operation, maintenance and disposal costs	0	29	16	13	26	84	288	3.43	1.25	1st
12. Use of Integrated Project Delivery (IPD) method – a team-based approach to design and construction that emphasizes collaboration and sharing risks and rewards of the project's success between all the stakeholders throughout the life of the project	6	26	10	29	13	84	269	3.20	1.24	3rd
13. Use of Public Private Partnerships (PPPs) where partnership is created between public and private entities allowing each side to benefit from a project	6	26	10	16	26	84	282	3.36	1.39	2nd
Average Mean								**3.19**	**1.25**	
Marketing Innovation (Ideas and activities to promote market success of products and services)										
14. Product or service differentiation	3	19	26	26	10	84	273	3.25	1.05	16th
15. Affinity/alliance marketing	3	26	29	13	13	84	259	3.08	1.11	21st
16. Partnership marketing	0	29	16	16	23	84	28	3.	1.	11

							5	39	22	th
17. Corporate social responsibility	6	20	26	16	16	84	268	3.19	1.21	17th
18. Customer feedback mechanism	3	24	32	6	19	84	266	3.17	1.18	19th
19. Social marketing/development of social bond	3	19	16	19	27	84	300	3.57	1.25	6th
20. Maintaining strong pool of professionals to boost company image	10	12	26	13	23	84	279	3.32	1.34	14th
21. Connection with other businesses	0	13	19	26	26	84	317	3.77	1.06	2nd
22. Writing proposals to attract clients	0	19	16	17	32	84	314	3.74	1.19	3rd
23. Being listed in business directories	3	23	23	19	16	84	274	3.26	1.16	15th
24. Use of promotional products (e.g. gifts given to clients for their patronage)	6	13	23	19	23	84	292	3.48	1.25	7th
25. Charitable initiatives	6	19	29	17	13	84	264	3.14	1.15	20th
26. Use of print media advertisement	3	16	26	23	16	84	285	3.39	1.11	10th
27. Use of broadcast media advertisement	3	19	16	30	16	84	289	3.44	1.14	9th
28. Use of company web site	6	13	26	13	26	84	292	3.48	1.28	8th

29.	Use of project signboard	3	6	19	23	33	84	329	3.92	1.11	1st
30.	Free design contribution	3	23	25	23	10	84	266	3.17	1.07	18th
31.	After sale services	0	23	26	19	16	84	280	3.33	1.08	12th
32.	Claim aversion	13	19	23	19	10	84	246	2.93	1.25	22nd
33.	Maintaining good track record	0	13	26	19	26	84	310	3.69	1.08	4th
34.	Optimal pricing	0	16	19	26	23	84	308	3.67	1.08	5th
35.	Granting credits/flexible payment options	6	16	26	17	19	84	279	3.32	1.22	13th
Average Mean									**3.40**	**1.16**	

NB: 1 = Never, 2 = Rarely, 3 = Sometimes, 4 = Often, 5 = Always, SD = Standard Deviation

Source: Field Survey, 2026

4.4 Benefits of Innovation

A total of 15 expected benefits of innovation to construction firms were identified, these benefits were presented in tabular form and the respondents were asked to indicate their level of agreement on these benefits to construction firms in Katsina State built on a five point scale; 1 “Strongly Disagree” indicating strong belief that the item in question is not a benefit, 2 “Disagree” indicating belief that the item in question is not a benefit, 3 “Neutral” indicating neither agree nor disagree (i.e. moderate view with latent inclination toward agreement or disagreement – depending upon the mean score), 4 “Agree” indicating belief that the item in question is a benefit and 5 “Strogly agree” strong belief that the item in question is a benefit. Table 4.4 shows the result of benefits of innovation to construction firms in Katsina State

based on the perception of professionals. An overall group mean and standard deviation of 4.11 (SD = 0.93) were recorded for the entire benefits of innovation which when approximated to 4.0 translate to "Agree" indicating that the respondents generally agree that all the identified benefits are benefits of innovation to construction firms. Furthermore, out of the 15 benefits identified, the top three leading benefits were: "gaining experience" with MIS of 4.27 (SD = 0.94), followed by "improves client satisfaction" with MIS of 4.23 (SD = 0.99) and then "ensures business sustainability" with MIS of 4.20 (SD = 0.95).

Table 4.4: Benefits of Innovation to Construction Firms in Katsina State.

S/N	Benefit	Frequency					∑F	∑FX	Mean	SD	Rank
		1	2	3	4	5					
1.	Ensures business sustainability	3	0	13	29	39	84	353	4.20	0.95	3rd
2.	Provides competitive advantage	3	0	6	49	26	84	347	4.13	0.83	8th
3.	Improves company/corporate image	3	0	10	42	29	84	346	4.12	0.88	9th
4.	Improves corporate/organisational performance	3	3	6	39	33	84	348	4.14	0.96	5th
5.	Increases market share/market growth	3	3	13	36	29	84	337	4.01	0.99	13th
6.	Improves profitability	3	0	13	39	29	84	343	4.08	0.91	10th
7.	Increases productivity	0	6	3	49	26	84	347	4.13	0.79	7th
8.	Intellectual property (patents, trademarks, designs)	3	0	19	43	19	84	327	3.89	0.88	15th
9.	Improves technical capability and managerial capabilities	0	6	13	36	29	84	340	4.05	0.89	12th
10.	Gaining experience	0	6	10	23	45	84	359	4.27	0.94	1st
11.	Enhances quality of construction output	3	3	6	32	40	84	355	4.23	0.99	2nd
12.	Improves client satisfaction	0	6	10	32	36	84	350	4.17	0.90	4th
13.	Improves human resources	6	0	6	36	36	84	348	4.14	1.07	6th
14.	Increases workers safety	0	6	16	29	33	84	341	4.06	0.94	11th
15.	Enables future business collaborations	3	3	16	30	32	84	337	4.01	1.02	14th
Average Mean									**4.11**	**0.93**	
NB: 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, and 5 = Strongly Agree, SD = Standard Deviation											

Source: Field Survey, 2026

5.0 CONCLUSION AND RECOMMENDATION

5.1 Conclusion

This study assessed innovation practices and the benefits of innovation among construction firms in Katsina State, Nigeria from the perspective of construction professionals. The findings revealed that the level of innovation practice among construction firms is moderate to occasional, with firms adopting various forms of product/technology, process, and marketing innovations. Among the product and technological innovations, the use of Building Information Modeling (BIM), Internet of Things (IoT), and Virtual Reality (VR)/Augmented Reality (AR) emerged as the most commonly adopted practices. Similarly, Life Cycle Costing (LCC), Public–Private Partnerships (PPPs), and Integrated Project Delivery (IPD) were identified as the leading process innovation practices, while project signboards, business networking, and proposal writing to attract clients were the most frequently adopted marketing innovation practices.

The study further established that innovation provides significant benefits to construction firms in Katsina State. The major benefits identified include enhanced professional experience, improved client satisfaction, and increased business sustainability. These findings demonstrate that the adoption of innovative practices contributes positively to organisational performance, competitiveness, and long-term growth of construction firms. Therefore, the study concludes that although innovation is being practiced by construction firms in Katsina State, there remains considerable opportunity to increase its adoption in order to maximize the benefits associated with improved productivity, service quality, and organisational sustainability.

5.2 RECOMMENDATIONS

Based on the findings, the study recommends that construction firms in Katsina State should increase the adoption of innovative technologies, processes, and marketing approaches to improve their overall performance and competitiveness. Particular emphasis should be placed on expanding the use of modern digital technologies such as Building Information Modeling (BIM), Internet of Things (IoT), and Virtual Reality/Augmented Reality (VR/AR), as well as innovative project delivery methods.Furthermore, construction firms should create an organisational culture that promotes innovation and continuous learning to maximize the benefits of innovation, including improved client satisfaction, enhanced professional

competence, and long-term business sustainability. By strengthening innovation practices, construction firms will be better positioned to improve productivity, deliver higher-quality projects, maintain competitive advantage, and contribute more effectively to the sustainable development of the construction industry in Katsina State.

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