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Appraising the role of building contracting firms in the digitalisation of artisans' skills development to achieving Sustainable Development Goal 8

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Introduction: Studies reveal that firms' leadership acumen, global best human resources practices, sustainable business, and organisational excellence through digitalisation can boost employees' skills development and economic growth. Extant studies reveal a scarcity of empirical materials regarding building contracting firms' role in developing artisans' skills, particularly in improving the achievement of Sustainable Development Goal (SDG) 8 (Decent Work and Economic Growth). This study appraises the role of building contracting firms in the digitalisation of Nigerian artisans' skills development and recommends ways to promote them and, by extension, improve the achievement of SDG 8.

Methods: This research utilised a qualitative method and interviewed 36 participants from Lagos and Abuja to achieve saturation at the 31st participant. It also adopted a thematic approach to analyse the data manually.

Results and discussion: Findings show that the contracting firm's role in digitalising artisans' skills development is pertinent, but implementation may face some barriers. The perceived barriers were clustered into three groups. Findings reveal that accomplishing SDG 8 may be threatened if these barriers are not curbed, and recommend ways to promote the firm in digitalising artisans' skills development to accomplish SDG 8. This study would stir stakeholders to embrace digitalisation to improve decent work, youth employment, and economic growth.

KEYWORDS

building artisan, contracting companies, decent work and economic growth,
digitalisation, Nigeria, skills development

1 Introduction

In the advancement and economic growth of nations, skills development is a relevant attribute that drives their economies. Ebekozien et al. (2024a) acknowledged skills development as a critical variable that influences the performance of building projects in the 21st-century. The weak outcomes of building projects is a recurring challenge (Daniel et al., 2020). Hasan et al. (2018) found that reduced productivity can be linked to a scarcity of skilled workers and an ageing workforce in the construction industry. Lu et al. (2015) found that a shortage of skilled workers may lead to poor performance. In South Africa, the Construction Industry Development Board (2017) opined that the shortage of skilled workers may reduce construction contractors' profits. Developing countries, including Nigeria, Ghana, India, South Africa, and Malaysia, are most affected by this due to a lack of sustainable training systems within building contracting firms (Ebekozien et al., 2024a). This calls for more attention to the skills development of building artisans. Ebekozien et al. (2024a) recommended ways to motivate young people to embrace construction trades to enhance economic growth through mass initiatives that target decent jobs and economic growth. This study appraises how building contracting firms can help bridge the gap in the skills development of artisans in Nigeria through digitalisation, thereby contributing to economic growth and the achievement of SDG 8.

According to Akinshipe et al. (2022), the building industry has undergone several changes over the past century. It is a manual-intensive industry, particularly in most developing economies. This may have contributed to hindrances to change for over five decades (Buehler et al., 2018) because manual-based labour results in stagnant productivity and low-profit outcomes. Akinshipe et al. (2022) argued that several industries had embraced business models and mechanical and technological mechanisms. Thus, the building industry cannot stand still, especially in real estate development, basic infrastructure, and other built assets, regarding design, construction, maintenance, and operation (Choudhary, 2019). Aghimien et al. (2018) found that the South African building industry's rate of embracing various innovations and technologies is still very slow. This is of concern in the 21st century, which is being driven by Fourth Industrial Revolution (4IR) technologies. Moreover, the building industry contributes greatly to global GDP—even more so in most developing countries (Oke et al., 2018). The 4IR can transform conventional into industrial production through digitalised processes (Hossain and Nadeem, 2019). The Gartner Glossary (2020) described digitalisation as transforming an event or task into a digital operation using digital technology. This process creates value and opportunity because of its automation using information technology (IT) systems (Savic, 2019). Akinshipe et al. (2022) emphasised that 4IR technologies can substantially benefit economic advancement in South Africa because digitalisation has been recognised as important for accelerating economic development. Therefore, embracing digitalised skills development via a contracting company's key role may improve productivity and profit and, by extension, the achievement of SDG 8.

Many researchers (Oni, 2014; Gitau, 2018; Golbahram and Chetty, 2018; Amusan et al., 2021; Yusuf et al., 2021; Akinshipe et al., 2022; Osuizugbo et al., 2022a; Osuizugbo et al., 2022b; Ebekozien et al., 2024a) have studied building artisans. However, problems persist, including in Nigeria; these require solutions, particularly in the 21st century, but no research has addressed the development of artisans' digital skills by building contracting firms and how this might improve the achievement of SDG 8. Osuizugbo et al. (2022b) examined the factors influencing career decisions among prospective artisans in the building industry. Ebekozien et al. (2024a) investigated the role of apprenticeships in developing the skills of building craftspeople to improve the achievement of SDG 8, but not from the perspective of digitalised skills and the contracting firm's role as a critical stakeholder. Advancing comprehensive leadership acumen, global best human resources practices, sustainable business, and organisational excellence driven by digitalisation can enhance employees' skills development and sustainable economic growth for construction companies. This is relevant for their stakeholders, especially contracting firms. This is one of our research motivations. The digitalisation of artisans' skills, led by contracting firms, will increase productivity and profit and, by extension, improve the achievement of SDG 8. This is because better productivity and profit will help foster an enabling working environment, job satisfaction, and economic value. In addition, bridging the skills gap of building artisans via digitalisation would create more jobs and mitigate social problems associated with youthunemployment.

Sustainable Development Goal 8 (SDG8) is a component of the 17 UN Agenda (United Nations, 2022). The United Nations (2022) and Ebekozien et al. (2024b) identified other previous goals, such as the Millennium Development Goals 2000–2015 (Valencia et al., 2019) and Agenda 21 at the Earth Summit in Rio de Janeiro, Brazil (United Nations, 2022). This research focuses on SDG 8 (Decent Work and Economic Growth) because of its positive influence on other SDGs if achieved. The successful digitalisation of the skills development of building artisans via the support of contracting firms may translate into increased productivity and profit for employers and employees. Integrating building contracting firms' leadership acumen, global best human resources practices, and organisational excellence attributes with the support of 4IR technologies may positively influence the achievement of the SDGs, particularly SDG 8, for building artisans. There is a paucity of empirical literature regarding Nigerian building contracting firms in the development of artisans' digital skills, particularly in achieving SDG 8. Thus, this study appraises the role of Nigerian building contracting firms in the digitalisation of artisans' skills development and recommends ways to promote them and, by extension, to better achieve SDG 8.

This study's objectives are to:

i.   assess the role of building contracting firms in digitalising the skills development of artisans.
ii. explore the perceived barriers facing Nigerian building contracting firms in digitalising artisans' skills development.
iii. propose ways to promote the digitalisation of artisans' skills development and, by extension, improve the achievement of SDG 8.

2 Review of literature

2.1 Artisans' skills development in the sector

Building artisans are a major component in the building industry and are critical in the continuity and project implementation. Hence, the availability of skilled artisans is a key factor in achieving a quality completed project. Like most developing countries, the Nigerian building industry relies on the informal, unsystematic training of artisans via apprenticeship (Ebekozien et al., 2024a). It is one of the mechanisms in mitigating the shortage of building artisans and improving labour productivity (Fernando et al., 2016; Johari and Jha, 2020). Fernando et al. (2016) identified six tasks in developing artisans' skills in the Sri Lankan construction industry: research, clearing house, coordination, awareness, training, and certification. Skills development is pertinent because most skilled artisans are engaged as general labourers in the first instance or as apprentices doing the task of a general labourer (Ebekozien et al., 2024a). These labourers become skilled after a few years of apprenticeship (Fernando et al., 2016). This approach has been the conventional mechanism, but the shortage of skilled artisans is increasing, although this is not a new issue. Henny and colleagues (as cited by Fernando et al. (2016) stated that strategies should be formulated for standards and training aspects to review the training curriculum. Fernando et al. (2016) identified an increase in work speed, the minimisation of wastage, and an increase in work quality as the benefits of the skills development of building artisans. However, this was not from the perspective of how 4IR technologies could be used to improve artisans' skills development.

Awe (2017) categorised building skills into artisan and non-artisan tasks. Ebekozien et al. (2024a) focused on artisan jobs that develop products and services, describing construction artisans as craftspeople who have learned the required trade skills and are trained by a mentor/trainer. Awe (2017) and Ebekozien et al. (2024a) identified the major building artisan trades as being the chainman, roofer, cement mason, plasterer, bricklayer, painter, carpenter, steel fixer, and electrician. In Nigeria, several trade centres have been established to enhance the development of artisan skills. An example is the National Directorate of Employment, established in 1986, which has established the open apprenticeship, school on wheels, and waste-to-wealth schemes (Evawoma-Enuku and Mgbor, 2005) targeted at young adults to learn vocational skills. A public–private partnership is the N-Build scheme, established by the Federal Government of Nigeria, the Council of Registered Builders of Nigeria, and the Nigerian Institute of Building to train young adults to become building artisans. It is a component of the Nigerian Federal Government Social Investment Program (Sambe, 2019).

Similarly, the Federation of Construction Industry and Julius Berger Plc collaborated to establish a joint craftsmanship skills development school (Ebekozien et al., 2024a) to address the paucity of construction artisans' skills (Julius Berger Nigeria, 2020; Yusuf et al., 2021). These training schemes highlight the responsibility of building contracting firms and the government to develop artisan skills by various means. In addition to being required to establish building jobs, to promptly meet project specifications and statutory obligations is

critical to meeting clients' satisfaction. Meeting this need has been challenging and has been compounded by modern design driven by digital technology. This may have rendered conventional skills development unsuitable in the 21st-century design, construction, maintenance, and operation of building projects. However, the literature regarding the role of digitalisation in skills development is scarce. There is a need to explore incorporating digitalisation into artisans' skills development to better achieve SDG 8. The relevance of the skills development of building artisans cannot be over-emphasised.

2.2 Role of Fourth Industrial Revolution (IR) technologies in building artisans' skills development

From the First Industrial Revolution in the 1700s to today's 4IR (Ibrahim et al., 2022), and migrating into the 5IR, people and technology connectivity have increased with better output. Hooker and Kim (2019) argued that the 4IR will transform lives for the better, bringing unprecedented changes to the world's cultural, social, and economic fabric. Park (2018) affirmed that 4IR is the main constituent of science, technology, engineering, and mathematics (STEM) through the quality of rapid innovations such as digitalisation and automation, advanced robotics, and artificial intelligence. Building artisans belong to this group. The challenges that confront STEM may double in the future (STEM Learning, 2018). Embracing 4IR technologies in the field may improve the development of artisans' skills. 4IR technology is classified into digitisation and virtualisation, simulation and modelling, and smart factory (Oesterreich and Teuteberg, 2016). The building industry, via artisans in contracting firms, can embrace 4IR technologies if given an enabling environment. This would benefit the industry. This includes bridging the skilled manpower shortage via technology, delivering smart homes, and providing basic infrastructure (Hawksworth et al., 2018). The use of 4IR technologies in artisans' skills development has not been encouraging among the contracting firms, particularly in developing countries. Therefore, as emphasised above, an investigation of the issues facing Nigerian building contracting firms in the digitalisation of artisans' skills development in Nigeria is relevant. This is the study's major evidence to investigate the perceived barriers facing Nigerian building contracting firms in this development.

2.3 Artisans' skills development to accomplish SDG 8

Skills development via digitalisation can offer economic growth for employers, employees, and society. SDG 8 comprises decent work, economic growth, and productive jobs (Perks and McQuiken, 2020). Ritchie and Ortiz-Ospina (2018) found at least 7% GDP growth per year for the economic growth of developing countries and *per capita*. A productive job is designated as work that creates enough income to allow employees and their households to consume above the poverty line (ILO, 2012). These attributes are relevant to employers, including building artisans. A "decent job" is when an individual can secure a productive job that delivers a "living

wage" and social protection for families to improve social placement (UN, 2018). Thus, this research focuses on digitalisation in the skills development of building artisans via contracting firms to achieve SDG 8. Achieving SDG 8 demands such development through an inclusive approach from the contracting firms. Young adult employment is among the 12 targets in SDG 8 (United Nations, 2015). This implies that improving artisans' skills via digitalisation in construction contracting firms will enhance decent work and economic growth. This is due to possible wages growth resulting from productivity increases.

2.4 Theoretical framework

The theoretical framework to promote the digitalisation of artisans' skills development and, by extension, improve the achievement of SDG 8 is neoclassical growth theory (NGT). For building contracting firms to enhance Nigerian artisans' skills development, embracing digital technology in new frontiers of the profession is very important. This economic theory combines technology, capital, and labour as the major driving variables. One of the variables, "technology", is the motivation for adopting this theory to tie the themes together. Ebekozien and Aigbavboa (2024) report that Trevor Swan and Robert Solow first developed the theory of long-term economic growth in 1956. The National Bureau of Economic Research (2023) affirmed that in 1957, Robert Solow identified the distinctiveness of technology and incorporated it into the model. The model will improve the profitability of Nigerian building contractors via artisans' use of digital technologies for optimal productivity. It will promote decent work and a rise in wages because of the firms' profitability. Through technological change (digital technologies), the model will strengthen its ability to achieve SDG 8. Sredojević et al. (2016) affirmed that NGT is a prominent theory, proving that technological change tailored to training and innovation, such as artisans' skills development, can generate economic growth because skills development via digital training relates to performance. Achieving this may be challenging because of the initial cost, resistance to change, and conventional technology. Thus, there is a need to identify the perceived barriers facing Nigerian building contracting firms in digitalising artisans' skills development. Plume and Mitchell's (2007) and Ebekozien and Aigbavboa's (2024) affirmed that construction, engineering, and management instructors should teach the basics related to digital technology concepts in construction-related disciplines.

3 Research methods

This study employed a qualitative research approach. Jaafar et al. (2021) and Ebekozien et al. (2025a), Ebekozien et al. (2025b) argued that qualitative research offers appropriate techniques to address the underlying issues in studies. The research also employed a phenomenological method—a qualitative research method that seeks to understand and describe the universal essence of a phenomenon (Neubauer et al., 2019). It is considered explorative via data collection from participants with their knowledge and experience (Ibrahim et al., 2022; Ebekozien et al., 2024c). The

research utilised semi-structured oral interviews. This allows for exploration of interviewee's insights (Ebekozien et al., 2025a). This data collection method aligns with Osuizugbo et al. (2022b), who explored the issues influencing intending building artisans. Figure 1 summarises the study's research design approach. The interviewees include consultant experts knowledgeable in the SDGs and 4IR technologies, construction consultants, construction firm representatives, and artisans. The researchers utilised aluminium windows/doors, iron bending/steel fixing, tiling, building electrical, plumbing, painting and decoration, carpentry, bricklaying, and masonry as the building trades. We interviewed 36 interviewees who were well-informed regarding 4IR technology's role in skills development and SDGs. This study also ensured adequate representation of the various clusters to strengthen the reliability and credibility of its findings (Table 1). Besides P3, P6, P12, P18, and P24, others were knowledgeable in the role that 4IR can play in skills development and, by extension, improving the achievement of SDG 8. The researchers triangulated the analysed data and accomplished saturation at the 31st interviewee when "new concept" perceptions from the study were no longer coming from the interviewees. This approach aligned with Braun and Clarke's work, as cited in Ebekozien et al. (2024a), who found that their research had accomplished saturation because of the absence of new innovative insights. The researchers engaged interviewees from Lagos and Abuja because these cities are centres of Nigerian building construction (Ebekozien and Aigbavboa, 2021). The researchers conducted a pilot study with six selected interviewees; the main interviews were from September to December 2024.

The main interviews lasted 51 min on average for the 36 participants interviewed. Regarding ethical issues, the participants were informed of the study's purpose, assured of their anonymity, and allowed to participate without coercion (Aigbavboa et al., 2023a; Ebekozien et al., 2025b). The researchers assigned labels to the data and adopted an open coding approach for the analysed data. This study utilised theming, in vivo, narrative, and emotion coding techniques (Corbin and Strauss, 2015; Ebekozien et al., 2020; Ebekozien et al., 2023). The inter-rater reliability of this study was 75%; it was done manually to establish the agreement of the same data obtained by different raters, applying the same parameters (Burns, 2014). This is because two investigators were involved in the collection and coding process. Table 2 summarises how the research design, data collection, and post-data analysis were guided. We identified and re-grouped 101 codes based on frequency, occurrence, and reference. Eight sub-themes emerged from the 101 codes which were re-clustered into three main themes guided by the study's objectives. The researchers triangulated the primary data, which aligned with Aigbavboa et al. (2023b), and converged to form sub-themes and themes. The researchers also used an expert to cross-check the main themes. To mitigate issues associated with validity, the researchers adopted the data collection triangulation method (Ebekozien, 2020). This study adopted a manual method via thematic analysis to analyse the collected data and was guided by prepared semi-structured questions. The basic questions were as follows. (i) What role can a building contracting firm play in digitalising artisans' skills development? (ii) Can you identify the perceived barriers facing Nigerian building contracting firms in digitalising artisans' skills development? (iii) How can Nigerian building contracting firms promote the digitalisation of artisans'
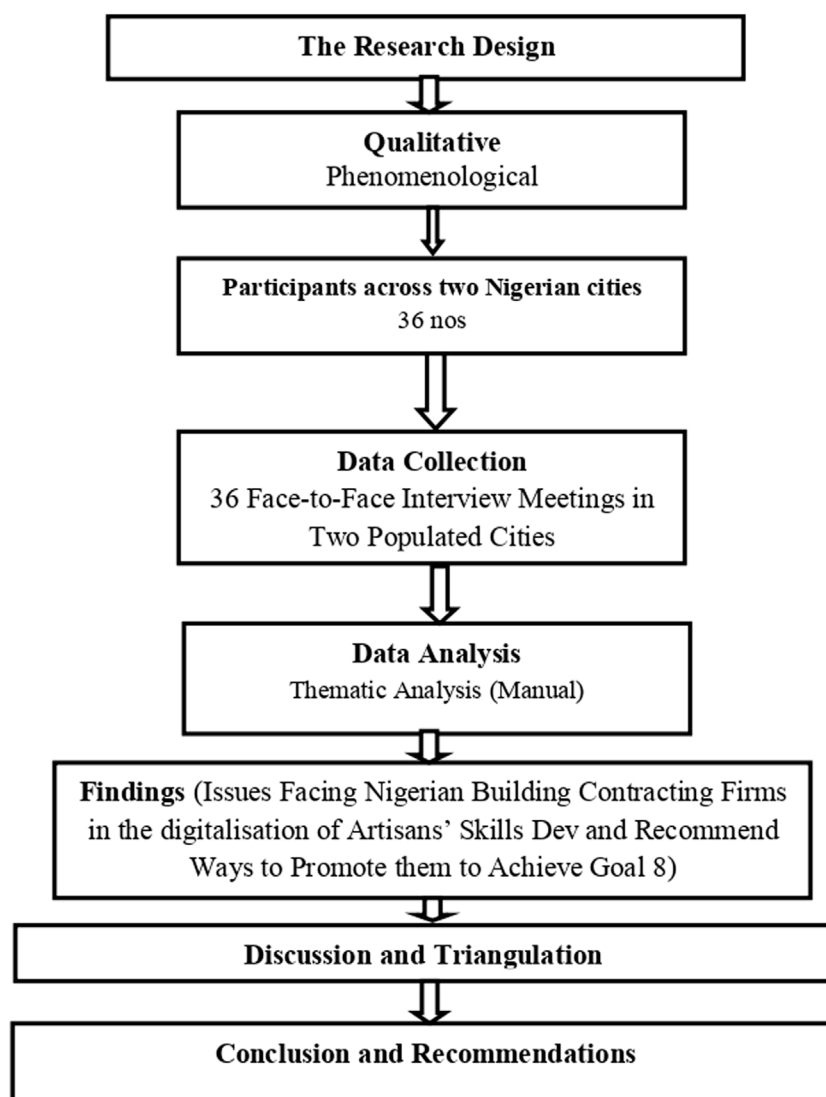
FIGURE 1
Research design.

skills development and, by extension, improve the achievement of SDG 8? The researchers' findings were based on the perspective of the 36 interviewees.

4 Findings and discussion

4.1 Theme 1: role of building contracting firms in digitalising artisans' skills development

The role of building artisans in contracting firms in strengthening performance and promoting organisational excellence is vital. Thus, contracting firms should pay more attention to their artisans' skills development in line with global best practices. The building sector cannot be left behind in the digitalisation trend; hence, there is a need to improve its skills development,

especially at a time of scarcity of quality artisans. Regarding this scarcity, the results align with Amusan et al. (2021), Yusuf et al. (2021), and Ayeyemi (2025), who reported the concerns of a frontline Nigerian building expert about the dangers of a lack of trained artisans in Nigeria's housing industry. Digitalisation will enhance the improvement of artisans' skills (majority). The findings reveal the vital contributions of skills development to building artisans and its impact on project delivery. It implies that if harnessed well, it can bridge the ageing skilled workers gap and improve the skills development and competencies of the artisans of contracting firms in digital tools and technologies (majority). Participant P32 said, "…integrated digital literacy training programmes will enhance skills development in building craftsmanship and mitigate the scarcity of trained artisans facing Nigeria's building sector, particularly in building-related trades such as electrical, plumbing, steel fixing, carpentry, masonry, and many more. I know how digital devices electricians can track faulty issues in a building

TABLE 1 Participants' description.

ID	Company	Firm code	Location	Number of employees	Years of experience	Participant rank
P1	Building firm (Large)	A	Abuja	350	25	Project Manager
P2		A		350	20	Foreman/Aluminium
P3		A		350	12	Bricklayer/Mason
P4		B		400	18	Management staff
P5		B		400	22	Supervisor/Painter
P6		B		400	15	Carpenter
P7	Building firm (Medium)	C		65	25	Managing Director
P8		C		65		Coordinator
P9		C		65		Supervisor/Plumber
P10		D		70	22	Site Manager
P11		D		70		Headman/Mason
P12		D		70		Headman/Iron Bender/Steel Fixer
P13	Building firm (Large)	E	Lagos	330	22	Management staff
P14		E		330	18	Supervisor/Tiler
P15		E		330	15	Supervisor/Plumber
P16		F		300	20	Contract Manager
P17		F		300	24	Supervisor
P18		F		300	20	Foreman/Electrician
P19	Building firm (Medium)	G		60	29	CEO
P20		G		60		Headman
P21		G		60		Foreman/Mason/Bricklayer
P22		H		55	33	Management Staff
P23		H		55		Supervisor
P24		H		55		Mason/Bricklayer
P25	Construction consultants with SDGs and 4IR technologies knowledge		Lagos		25	Deputy Director/Architectural firm
P26					34	Principal Partner/QS firm

(Continued on the following page)

TABLE 1 (*Continued*) Participants' description.

ID	Company	Firm code	Location	Number of employees	Years of experience	Participant rank
P27					28	Director/Architectural firm
P28					20	Senior Engineer
P29			Abuja		24	Partner/Structural firm
P30					29	Senior Partner. Structural firm
P31			Lagos		22	Operation Director
P32	Construction skills consultants with SDGs and 4IR technologies knowledge				15	Head, Training Unit
P33					20	Operation Manager
P34					18	Skills Coordinator
P35			Abuja		22	Partner, Skill Manager
P36					21	Training Manager

Source: Authors' work.

TABLE 2 Study's quality evaluation techniques.

Method	Assessment strategies	The phase of research
Reliability	Interviewers' well-guided (consistent)	Data collection
Validity	The adoption of a recognised method (semi-structured interview questions for 36 participants)	Data collection
Generalisability	Recognition of limitations due to sample size, potential interviewer bias	Data analysis
Transferability	Compare the study's implications against the reviewed literature.	Post data analysis
Credibility	Thematic approach to establish a pattern from the data	Data analysis
Dependability	Developing semi-structured interview guidelines (Appendix A).	Research design

Sources: Modified from Ebekozien et al. (2024a).

without claiming the ceiling. However, the ability to use the device is pertinent…" Participant P32 highlighted the benefits of digital technology and emphasised the need for training. The findings reveal that digitalisation can enhance artisans' accuracy and their optimisation of construction materials to satisfy clients (majority).

The findings reveal that the digitalisation of the skills development of building artisans will promote sustainable business for contracting firm and strengthen project performance. The digitalisation of skills development will transform both the contracting firms and workers (P6, P12, P18, P25, P32, and P36). These findings align with Godfrey (2025), who found that the Office of the Head of the Civil Service of the Federation and the National Information Technology Development Agency have commenced a new digital literacy training program for federal civil servants which aims to equip workers with basic skills to enhance their productivity

and efficiency in an increasingly digital era. In addition to digital transformation's improvement of client satisfaction through quality projects, reducing cost and time overruns, improving value, and reducing construction wastage (P1, P3, P9, P13, P19, P24, P30, P32, and P35), it can integrate learning, innovation, and new technological skills in line with global best practice (P2, P13, P25, P29, and P35). The findings agree with Fernando et al. (2016), who identified increased work speed, the minimisation of wastage, and increased work quality as the benefits of the skills development of building artisans. The findings also agree with Konstantinou and Miller (2020), who underscored the demand for work-integrated learning and skills development. This study reveals that despite digitalisation's role in the skills development of building artisans, many contracting firms are not embracing it. This implies that there are hindrances facing building contracting firms in the digitalisation

of artisans' skills development (majority). These hindrances may influence the achievement of SDG 8 if not curbed.

4.2 Theme 2: hindrances facing building contracting firms in the digitalisation of artisans' skills development

Despite the relevance of digitalisation in the skills development of building artisans to promote a sustainable industry, the artisans of most contracting firms still need to improve to become valuable to modern design and construction in line with best global practice. "…many painters cannot do common screeding. One can learn this task via YouTube as a painter with basic knowledge. How many can access YouTube?" queried participant P14. The introduction of digitalisation in the skills development of building artisans as an innovation to improve productivity and project excellence in Nigeria's building industry requires an institutional framework driven by contracting firms. This is this study's goal. Its findings identified the perceived barriers that may hinder building contracting firms in digitalising artisans' skills development. The hindrances can be typified as "most severe," "severe," and "fairly severe" hindrances. The scale of hindrance was based on the frequency of occurrence (Table 3). An absence of basic infrastructure investment that promotes digital literacy training, a lack of company ICT-driven policy, inadequate investment in ICT-driven equipment, and funding challenges, among others, emerged as the most severe hindrances that may hinder building contracting firms in the digitalisation of artisans' skills development. Regarding the lack of company ICT-driven policy, inadequate investment in ICT-driven equipment, and funding challenges, participant 36 said, " …how many contracting firms, especially the indigenous ones, can afford ICT-driven tools and equipment, for example, a complete set of leak detection equipment, mortar/plastering sprayer, bricks laying machine, digital tile fixing machine, etc. Leak detection equipment is a new technology for accurate detections, with precise findings, especially in conduit piping …" Affordability is challenging to most medium and small contracting firms. The findings revealed that leak detection equipment is expensive and must be used by plumbers with ICT knowledge (P9, P15, P17, P28, and P33). The device can identify the specific area of the leak and mitigate the invasive techniques to search the leaking pipe and make repairs with just one touch on the pipes, stub-ups, and angle stops throughout the property. It improves artisans' productivity skills and promotes organisational excellence. The results align with Ebekozien and Samsurijan (2024), who found that inadequate funding in basic infrastructure was a challenge to digital technology's take-up in the construction industry.

The following emerged as severe hindrances to building contracting firms in the digitalisation of artisans' skills development: inadequate technical expertise to manage ICT tools and equipment, reluctance to change organisation and processes, contracting management team's hesitation to adopt, contracting firm's lax attitude to innovation, and inadequate instructors and supervisors. These threaten SDG 8's accomplishment. Regarding the severe hindrances, the findings agree with Perera et al. (2021) and Ebekozien and Samsurijan (2024), who found that resistance to innovative technologies, a paucity of enhanced skills, refusal to adapt

to new technology, and hindrances in organisational and process changes were identified as the barriers facing IR4 implementation. Participant P30 said, " …digitalisation of building artisans' skills development to promote sustainable industry is a long-term benefit-driven mission. However, most contracting firms do not have a company's ICT-driven policy, including upgrading artisans' skills via training…This is not the case in most advanced countries; artisans are exposed to digital equipment to enhance their performance and improve productivity…" Bringing this challenge to the fore of research will trigger possible solutions. These results align with Oesterreich and Teuteberg (2016) and Ebekozien and Samsurijan (2024), who identified organisational issues as hindrances that, if not curbed, may hinder digital technology usage in the industry, including artisans' skills development. Regarding the fairly severe, lax long-term relationship between the employer and employee, fragmented and project-based nature of the industry, inadequate investment in research and development, the weak educational background of artisans, and the working environment and absence of motivational packages, the results align with Bilau and colleagues as cited in Ebekozien and Samsurijan (2024), who identified inadequate motivation, an absence of formal education, and lax career guidance as issues facing construction workers. Our findings reveal that strategies to mitigate the identified hindrances and, by extension, promote the digitalisation of artisans' skills development cannot be over-emphasised due to their negative influence on achieving SDG 8, especially in developing countries like Nigeria.

4.3 Theme 3: ways to promote the digitalisation of artisans' skills development to achieve SDG 8

This study revealed that the digitalisation of artisans' skills development by contracting firms can provide all-inclusive economic growth and decent employment and, by extension, improve the achievement of SDG 8. The role of building contracting firms is key. In addition to participants P1, P7, P8, P13, and P19, the findings revealed that most contracting firms still expect the government to lead in programs such as the digitalisation of skills development to enhance productivity, profit, and organisational excellence in line with global best practice. Participant P13 said, "…it's not true that contracting firms are not willing to switch artisans from the conventional to digital skills upgrading, but it is capital intensive …and the government has a responsibility to intervene if they [government] want us to achieve SDG 8 via a decent work environment…" The findings agree with Meera and Vinodan (2022), who affirmed that a decent work environment will enhance the achievement of SDG 8. Participants P27, P30, P31, and P36 were of the opinion that while the SURE-P program, the National Vocational Qualifications Framework, and Skill-Up Artisans are government initiatives, digitalisation is not incorporated into them. In the 21st century, digitalisation should be encouraged in line with global best practice to make Nigerian artisans globally competitive. These findings suggest an all-inclusive mechanism with a developed company's framework to impart digitalisation in the skills development of artisans to engage youth, making artisan careers more attractive to them (majority). Our findings agree with Osuizugbo et al. (2022b), who affirmed that major parties

TABLE 3 Major hindrances to building contracting firms in the digitalisation of artisans' skills development.

S/Nos	Hindrance	Source
	Most severe	
1	Absence of basic infrastructure promoting digital literacy training	Majority
2	Lack of company ICT-driven policy	Majority
3	Inadequate investment in ICT-driven equipment	Majority
4	Funding challenge	Majority
	Severe	
1	Inadequate technical expertise to manage ICT tools and equipment	P2, P3, P7, P16, and P33
2	Organisation and process hard to change	P1, P4, P14, P25, P29, and P33
3	Contracting management team's hesitation to adopt	P1, P4, P5, P8, P13, P18, P24, and P36
4	Contracting firm's lax attitude to innovation	P3, P7, P12, P26, P33, and P35
5	Inadequate instructors and supervisors	P2, P6, P9, P10, P15, P24, P31, and P34
	Fairly severe	
1	Lax long-term relationship between employer and employee	P5, P8, P10, P11, P16, and P30
2	Fragmented and project-based nature of the industry	P7, P10, P15, P19, P23, P27, and P31
3	Inadequate investment in research and development	P2, P16, P19, P27, P30, and P35
4	Weak educational background of artisans	P8, P19 – P27, P33, and P36
5	Working environment and absence of a motivational package	P4, P13, P18, P25, P30, and P33

Source: Authors' work.

such as contracting firms should collaborate with young adults to mitigate the scarcity of skilled workers in the building industry. In relating this to improving the achievement of SDG 8, participants P15, P19, P25, and P30 affirmed that the right contracting firm framework would create an enabling working environment and promote ICT tools and equipment policies, making achieving SDG 8 feasible. These findings reveal that digitalisation is the way forward in the 21st century and that artisans cannot be left behind. However, mechanisms should be established for upskilling and retraining artisans in modern digital tools and equipment that will improve their working environment (majority).

Hence, a firm's role in digitalising the skills development of artisans to achieve SDG 8 cannot be minimised. This study reveals that most responsibility for promoting ICT in artisans' skills development lies within building firms, and embracing ICT programs is pertinent to sustain such development (P1, P7, P13, P19, and P31–P36). "…building firms should embrace the digtalisation in skills development as a component of the organisational policy. This is germane to bridge future ageing skills because digital literacy is youth-friendly……" said participant P31. Regarding ways to promote the digitalisation of artisans' skills development to accomplish SDG 8, top strategies were reported as contracting firms investing in basic infrastructure that promotes digital literacy training within the organisation,

developing an ICT-driven policy with investment support in ICT tools and equipment, highlighting the benefits of digitalisation skills development, and promoting a positive mindset towards digitalising artisans' skills development. Others include encouraging long-term relationships between the employer and employee, investing in research and development, providing motivational incentives to workers, and offering basic education to them. These findings agree with Underwood et al. (2021), who argued that incentivisation can integrate building project delivery and enhance productivity. Regarding the benefits of digitalisation, the findings agree with Chang (2018), who recommended that policymakers, such as contracting chief executive officers, should build an understanding of the impacts of ICT on the building industry for further growth.

5 Research implications

This research investigated the role of and perceived barriers facing Nigerian building contracting firms in digitalising skills development in artisans. Based on the hindrances that emerged, this study offered ways to promote these firm's role in that digitalisation and, by extension, improve the achievement of SDG 8. This was missing in the extant literature and formed part of its

implications. The 14 hindrances that emerged were re-grouped into three clusters (Table 3). The dimensions/constructs clustered into "most severe", "severe", and "fairly severe" will assist policymakers in understanding possible issues and how to mitigate them and, by extension, promote the role of contracting firms in the digitalisation of artisans' skills development to improve the achievement of SDG 8.

This research also provides stakeholders—in this context, constructing contracting companies and their workers—the opportunity to engage in measures that will assist in promoting the digitalisation of the skills development of construction artisans to improve the accomplishment of SDG 8 by 2030. This is in line with the 17 UN SDGs. As well as improving the achievement of SDG 8, other goals connected with artisans' welfare, such as SDGs 1 and 2, may be accomplished. This is pertinent to promoting all-inclusive leadership acumen, global best human resources practices, sustainable business, and organisational excellence of building contracting firms by digitalising their artisans' skills development to economic growth. Digitalisation is the correct way forward and should be embraced by all. The findings can motivate policymakers, especially construction companies, to explore ways to promote the digitalisation of artisans' skills development to better achieve SDG 8. This research can assist stakeholders to better understand digitalisation in artisans' skills development and suggest ways to promote skills development through digitalisation to achieve SDG 8.

6 Study's limitations and recommended areas for future studies

This research has limitations. It adopted a qualitative method in data collection, with 36 interviewees. The researchers covered Abuja and Lagos in Nigeria. Besides Table 2, which enhanced the study's quality evaluation techniques because of the potential biases associated with interview and manual coding guiding the research design, data collection, and post-data analysis, the in-depth extant literature review and robust findings discussion mitigated these limitations. Future researchers could consider a wider coverage within or outside Nigeria using a quantitative research method. For continuity, we suggest a mixed-methods approach for future research. Researchers could investigate the role of other stakeholders, such as government and employees, to complement that of construction companies in future studies and how they can influence the achievement of SDG 8.

7 Conclusion and recommendations

This research investigated the role of building contracting firms in digitalising Nigerian artisans' skills development. It recommended ways to promote them and, by extension, better achieve SDG 8. This study has revealed that construction companies have a significant role in digitalising artisans' skills development to achieve SDG 8. This research identified 14 perceived barriers and grouped them as "most severe," "severe," and "fairly severe." The hindrances include an absence of basic infrastructure investment to promote digital literacy training, a lack of ICT-driven policy by companies, inadequate investment in ICT-driven equipment, and funding challenges. The findings recommended inclusive ways to promote digitalisation in artisans' skills development to achieve SDG 8, as follows.

i. Construction companies should be intentional regarding digitalisation reflected in their policy and mission statement, with a reasonable yearly budget for training and digital equipment. Once companies deliberately and intentionally promote organisational excellence through digitalisation, artisans' skills development through digitalisation will be easier to embrace and implement, and, by extension, SDG 8 better achieved. This will enhance artisans' employability, higher wages (leading to economic growth), better project outcomes (decent work), and working environment.

ii. Companies should develop a sustainable framework to skill employees, including construction crafts skills training and development, and a phased approach from conventional to digitalised. This would mitigate implementation challenges such as cost, training, capacity, and resistance to change. This vision will require a positive mindset and strategic leadership acumen by management teams. The outcome will strengthen performance and promote sustainable business, leading to organisational excellence in project delivery and productivity, including sustainable profit for companies and economic improvement for artisans.

iii. Besides construction contracting firms and artisans, collaboration with other stakeholders such as government, vocational institutions, private technology firms, and NGOs involved in digital training would enhance a more holistic approach to implementing digitalisation in the construction industries of developing countries.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors without undue reservation.

Ethics statement

The participants provided written informed consent to participate in this study.

Author contributions

AE: Methodology, Project administration, Software, Data curation, Visualization, Writing – original draft, Conceptualization, Validation, Investigation, Resources, Writing – review and editing, Formal Analysis, Supervision. MH: Resources, Supervision, Project administration, Writing – review and editing, Methodology, Funding acquisition, Investigation. CA: Conceptualization, Resources, Investigation, Supervision, Funding acquisition, Methodology, Writing – original draft. MSh: Project administration, Writing – review and editing, Formal Analysis, Validation, Investigation, Funding acquisition, Resources. AN: Formal Analysis, Writing – original draft, Resources, Project administration, Methodology, Conceptualization. MSa: Writing – review and

editing, Validation, Conceptualization, Investigation, Software, Methodology, Resources, Funding acquisition, Formal Analysis, Project administration, Writing – original draft. NG: Funding acquisition, Writing – review and editing, Investigation, Writing – original draft, Resources, Data curation, Project administration, Formal Analysis, Methodology, Conceptualization. RA: Writing – original draft, Conceptualization, Software, Investigation, Writing – review and editing, Formal Analysis, Project administration, Methodology, Data curation. EE: Project administration, Formal Analysis, Writing – original draft, Data curation, Methodology, Conceptualization, Investigation, Supervision, Validation, Writing – review and editing, Software.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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