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Managing construction project risks in turbulent times: a stakeholders perspective

Andrew Ebekozien, Clinton Aigbavboa, Mohamad Shaharudin Samsurijan, Mohamed Ahmed Hafez Ahmed, Opeoluwa Akinradewo and Igbebo Omoh-Paul
(Information about the authors can be found at the end of this article.)

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Abstract

Purpose – The construction industry is unique but with uncertainties. This is because of the operating environment. This intricacy gives rise to several construction risks and is compounded in developing countries' turbulent times. If not managed, these risks enhanced in turbulent times could negatively impact the Nigerian construction projects' cost, time, quality, and performance. Hence, this study investigated the perceived encumbrances facing construction risk management techniques and identified measures to promote sustainable-based construction risk management in turbulent times.

Design/methodology/approach – The researchers adopted a qualitative approach and achieved saturation with 28 participants. The participants were government policymakers, quantity surveyors in government ministries/agencies/departments, consultant engineers, consultant architects, consultant and contracting quantity surveyors, and construction contractors knowledgeable about construction risk management. The research employed a thematic analysis for the study's data.

Findings – Findings identified turbulent times related to the industry and major techniques for managing construction project risks in the Nigerian construction industry. It revealed lax adoption and implementation of practices. Also, the study identified major encumbrances facing construction risk and proffered initiatives that would promote sustainable-based construction risk management in turbulent times.

Originality/value – This study investigates encumbrances and suggests measures to promote construction project risk management in turbulent times in Nigeria. Also, the study contributes to the literature's paucity, uncovering perceived encumbrances and evolving organisations' management styles to imbed sustainable-based risk management practices by qualitative research design method.

Keywords Adoption, Implementation, Nigeria, Risk management, Stakeholders, Sustainable construction

Paper type Research paper

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1. Introduction

The 21st Century global community is characterised by encumbrances (internal and external shocks). These shocks include global fragilities, societal upheaval, economic volatility (George *et al.*, 2016), climate change-induced natural disasters, accelerated geometric inflation, migrant crises, cyberattacks, youth restiveness, kidnapping, currency redesign crisis, floating of the naira, fuel subsidy removal, invasion of Ukraine, and pandemics such as COVID-19 (Ebekozien and Omoh-Paul, 2023). These events pressure construction activities, including the supply chains (Foli *et al.*, 2022). The movement restriction to prevent or mitigate the spread of COVID-19 across the country makes managing construction projects more difficult in the pandemic era (Ebekozien and Aigbavboa, 2021). The unprecedented lockdown in line with the COVID-19 guidelines may have increased construction risks associated with the projects. The COVID-19 impact on construction projects in developing countries includes firms being incapacitated to honour salaries, the Nigerian economic crippling into recession, cost and time overrun, increased unemployment, etc. These threatening commotions indicate a paradigmatic fracturing of economic, social, and political orders in dysfunctional multilateral societies. They are disruptive developments. It could lead to a fragmented and disintegrated era if pragmatic, collaborative, and coordinated efforts are not inspired and engaged (Bolewski, 2021). The inadequate knowledge about these internal and external multiplex turbulences makes it complicated to comprehend, analyse, alleviate, and react immediately to economic, social, and environmental issues (Rice and Zegart, 2018). The construction industry and its products are not exempted from these vehement and recurring emergencies in complex, changing environments.

Globally, the construction sector is worth over US$10 trillion yearly (Bogue, 2018) and is key to infrastructural development. The sector mainly contributes to many countries' social and economic growth. The industry is key to social and economic development (Zhao, 2022). The industry is complex and unique because of the contexts linked with each construction project. Methods and techniques related to each construction project are key in this regard. Construction projects are pertinent for implementing change and investment (William, 2010; Manhart *et al.*, 2020; Wu and Zhu, 2021). Therefore, the intricacy gives rise to several risks that can affect construction projects' quality, cost, time, and overall sustainability (Ebekozien and Omoh-Paul, 2023). If not managed, these risks could influence construction projects' quality, time, cost, and performance. Sustainable development is achieved by managing construction project risk excellently and ensuring reasonable completion of quality projects within the approved budget through sustainable practices. This is one of the motivations for this study. Ebekozien and Omoh-Paul (2023) and Oke *et al.* (2023) corroborated this by identifying the impact of unmanaged construction risks on projects. However, their studies were reviewed, and conclusions were drawn without empirical data. This includes ineffectiveness in decision-making, liabilities, financial issues, and uncertainties in project outcomes. Participants in the industry need to be mindful of the increased construction risks associated with projects to ensure the timely completion of projects within the proposed budget and acceptable quality. Managing construction project risks in turbulent times, especially in developing countries like Nigeria, cannot be over-emphasised.

The increasing socio—economic and environmental uncertainties (kidnapping, pandemics, banditry, fuel subsidy removal, floating of currency, geometric inflation, cybercrime, etc.,) especially in developing countries such as Nigeria, forces construction firms to consider careful the risk factors influencing their operation continuity and factors that would enhance their sustainability in times of crisis. However, there is a gap regarding the perceived encumbrances facing existing construction risk management techniques and possible measures to promote new sustainable-based construction risk management techniques in turbulent times in Nigeria. This is because the global pandemic (COVID-19) exposed the inadequacies of the conventional

risk management method (Settembre-Blundo *et al.*, 2021). The era of financial quantification of technical risks and improving strategic selection has passed.

Among the global solutions that have been adopted to promote sustainable-based construction risk management include a developed new interpretative framework for firms' risk management strategies analysis, comprehensive risk management function planning process, resilience and flexibility, supported with integrated mechanisms (Settembre-Blundo *et al.*, 2021), risk assessment and vulnerability (Zhao, 2022; Cevikbas *et al.*, 2024), risk management mitigation framework of a construction project in developing countries (Wang *et al.*, 2004), innovative methodological tool via innovative organisational structures (Biron *et al.*, 2021), a quality management framework for public-sector housing delivery (Amoah, 2023), holistic view of each type of risk and its impact on sustainability (Tsalis *et al.*, 2020), technological turbulence (Foli *et al.*, 2022), collaborative strategies (Cangemi *et al.*, 2011; Manhart *et al.*, 2020), and strengthen the relationship between risk management techniques and corporate sustainability evaluation in line with the 2023 Agenda (Tsalis *et al.*, 2020). Whether these possible solutions have been considered by a few studies conducted in developing countries' context of improving construction risk management in turbulent times for possible implementation to enhance organisations sustainability is uncertain; hence, motivated the study. This study will show how stakeholders in the construction industry can achieve more gains by taking advantage of the opportunity and mitigating risk and uncertainty in turbulent times. Also, it will promote more awareness of sustainable risk management practices in turbulent times. Thus, identifying encumbrances facing construction risk management techniques, especially in turbulent times, is germane to achieving this goal. This study investigates the perceived encumbrances facing construction risk management techniques and identifies measures to promote sustainable-based construction risk management in turbulent times. Specifically, the study will accomplish this research via the following objectives:

To identify various risk management techniques in turbulent times.

To investigate the perceived encumbrances facing construction risk management techniques in turbulent times.

To identify measures to promote sustainable-based construction risk management in turbulent times.

The study is structured as follows. First, a short overview of managing construction project risks in turbulent times is provided. The literature review's background regarding managing construction project risks in turbulent times is followed, and the third is the description of the research method adopted. Next is the findings and discussion section that addressed the objectives. The fifth section is the study's implications. Next are the study's limitations and areas for further studies. The study concludes with a conclusion and recommendations section.

2. Literature review

2.1 Overview of risk management in turbulent times

Risk occurrence and impact on construction projects varies during the project life cycle. There is a high degree of risk linked with quality, time, and cost if project information is incomplete, especially in the early phase of the construction project. Oke *et al.* (2023) affirmed that the increased certainty mitigates the project risk level. For this study, the International Organisation for Standardisation [ISO] (2018) defines risk as the "*effect of uncertainty on objectives,*" while risk management (RM) is defined as "*coordinated activities to direct and control an organization with regard to risk*." Construction project risks are interrelated because they can influence the occurrence of one another (Goh and Abdul-Rahman, 2013).

Risk perception differs at personal and corporation levels. People's views differ regarding risk consequences, probabilities, sources, elements, and preferred actions. Project Management Institute [PMI] (2004), Loosemore *et al.* (2006), and Oke *et al.* (2023) opined that risk does not essentially involve only negative outputs; it can enhance positive outcomes or opportunities. Hence, PMI risk definition includes negative consequences and opportunities. It implies that every opportunity has an associated risk, and every risk could lead to opportunity. Loosemore *et al.* (2006) defined risk as "*a possible future event, the occurrence and consequences of which are uncertain, but which could affect the company's ability to achieve its project objectives.*" Managing these risks is pertinent to achieving the set goals of construction projects. Goh and Abdul-Rahman (2013) identified financial, time, personnel, design and technical, contractual, physical, political and regulation, and safety risks as the major risks in the construction industry and their negative impacts on construction project cost, time, and quality in this order. They found that besides the overall rank (risk occurrence) for financial and time risks, both were ranked first and second across impact on cost, time, and quality. For this paper, physical risk implies extreme inclement weather, earthquake, flood, fire, subsidence, etc., and political and regulation risk means unstable government policy, expropriation, and corruption.

Risk management is a proactive decision-making process to mitigate the impacts of known or negative incidences. It is impossible to eradicate risk from a construction project, but it could be curtailed with precise proactive initiatives. Risk management is critical in diverse uncertainties, especially in construction supply chains (Pham *et al.*, 2023). Goh and Abdul-Rahman (2013) identified key steps in the risk management process. This includes risk planning, identification, analysis, response, monitoring, and control. A competent risk management implementation can mitigate project time overruns and long-term loss expenses. Similarly, it can assist in ascertaining the viability of a construction project. Goh and Abdul-Rahman (2013) postulated that competent risk management should convert doubt into risk and opportunity. Risk management has a history. In the early 1990s, construction project risks became a concern to stakeholders, leading to the design of various mechanisms by contractors/developers for analysing and evaluating these risks. Al-Bahar (1988) found that this approach threatened the triple constraints (i.e., cost, time, and quality of the project) because of the failure in construction works. A mechanism was developed in the millennium to resolve the issue. Chapman (2001) and Shen *et al.* (2001) classified risks. Chapman (2001) grouped risk into project, employer, industrial, and environmental risks. Shen *et al.*, (2001) grouped risk based on its occurrence. This includes political, policy, market, management, legal, and financial risks. During the millennium phase, Goh and Abdul-Rahman (2013) clustered several risk factors into five different stages.

Settembre-Blundo *et al.* (2021) affirmed that the COVID-19 pandemic was a global turbulence and affected all economic sectors. This includes the construction industry. This forced massive construction staffers to remote work with consciousness of spacing, changes in the industry landscape, and regulations restricting mobility (Biron *et al.*, 2021). Thus, raising the need for a paradigm shift to enable a new risk management mechanism of development that is economically, socially, and environmentally sustainable. They affirmed that the COVID-19 scenario exemplifies how firms should respond to evolving human-related encumbrances. Thus, innovative organisational structures for proffering answers to human-related encumbrances would integrate the learning insights and enhance ways of critical thinking. Organisational structure defines roles and the associated mechanisms to control, coordinate, and integrate work tasks. Foli *et al.* (2022) and Ku (2022) affirmed that technological turbulence increased information processing capacity. The outcome assists organisations in focussing on trends concerning technology. Technological turbulence has brought opportunities for organisations (Huo *et al.*, 2022). Technological turbulence enhances

firms' ability to update their knowledge as technology evolves. Hence, reskilling and upskilling are vast for technology knowledge. The outcome may result in innovation.

2.2 Risk management practices in a developing country

Nigeria is among the top economies in Africa. The construction industry has played an important role in this regard (Bello and Ayegba, 2024). Okudan *et al.* (2021) affirmed that risk management is vital for organisations operating in the industry. The industry makes important long- and short-term contributions to the Nigerian economy (Olanipekun and Saka, 2019). The industry is challenged with dilapidated and a need for more infrastructure. International Trade Administration (2021) reported that the country's infrastructure stock amounts to 30% of its GDP as of 2021. This is far below the benchmark set by the global apex bank. Goh and Abdul-Rahman (2013) identified feasibility, design, tendering, construction, and handling and maintenance stages as the major risk occurrences throughout the construction project stages. Risk associated with maintenance stage need to be mitigated. Maintenance is pertinent in the life of a building, especially heritage and historic buildings (Bertolin and Berto, 2024). They found that the construction stage has the highest risk occurrences, followed by the tendering stage. The construction stage of major projects takes longer to complete and involves many investments. This implies that different types of risk arise at different stages in the life cycle of a construction project. Contribution to construction project success, producing better business outcomes through more informed decision-making, enhanced creative thinking, innovation, reducing overhead and time waste, recognising uncertainty, and providing forecasts of possible outcomes were identified as the major benefits of the use of risk management tools in construction projects (Belel and Mahmood, 2012; Zailani *et al.*, 2019).

Belel and Mahmood (2012) and Zailani *et al.* (2019) found insufficient skilled personnel, inadequate contractor experience, new technology, changes in construction project scope and requirements, subcontractors, incompetently defined roles and responsibilities, and design errors and omissions as the top-ranking risk sources in construction projects in Nigeria. They identified four basic widely accepted risk management processes in line with project management literature. The four phases include risk identification, estimation, response planning, and execution. However, an appropriate risk mitigation strategy is key to decreasing the chances of potential impact or probability of occurrence. Zailani *et al.* (2019) classified frequently used risk mitigation strategies into avoidance, retention/acceptance, control/reduction, and transfer/deflect.

2.2.1 Risk management process. Risk management is knowledge intensive (Okudan *et al.*, 2021). It is clustered into five steps (Ebekozien and Omoh-Paul, 2023; Oke *et al.*, 2023). This includes:

(1) *Describe the case context:* Understanding the context of the risk occurrence is critical as considering the organisation and strategic contexts.

(2) *Identify the risks:* The goal is to determine what is happening and the expected consequences. Basic questions to ask are: What could happen? What causes it to happen? What is the probability of the risk happening? What will be the implications?

(3) *Conduct a risk analysis:* Evaluating the probability and consequences of each identified risk is pertinent. The risk with the biggest impact should be given priority regarding managing and monitoring the risks.

(4) *Treat the risks:* This involves a variety of treatments with options. Risk treatment options should be considered, and the severity of the risk should be considered. Treatment alternatives include risk acceptance, avoidance, reduction, transfer, retain, and risk finance.

(5) *Monitor and review treated risks:* At this final stage, consultation, monitoring, and reviewing are continuous risk management features. One should ensure the process is documented and records kept for reference.

Managing construction project risks in turbulent times should be a systematic process of identifying, analysing, and responding to them (project risks). This is pertinent because construction activities have risk and become compounded during turbulent times such as flood, fire, earthquake, youth restiveness, kidnapping, pandemic, financial meltdown, etc. (Ebekozien and Omoh-Paul, 2023). The systematic process would increase the opportunity and positive events. Also, it would mitigate the probability and effect of negative events. This implies that the chances of a successful construction project will increase (Oke *et al.*, 2023). As previously described, risk management as a mechanism is a decision-making process to ensure that appropriate measures are put in place to reduce the impact of already identified risks and their probability of happening. This would mitigate the risks and intricacies and increase the prospect of construction project accomplishment. Attempts at coordinating risk analysis management between developers/construction contractors and employers/clients have not been formalised. This is because stakeholders' objectives differ. Belel and Mahmood (2012) and Oke *et al.* (2023) highlighted the four processes involved in risk management. This includes risk identification, risk quantification, risk response development, and risk response control.

2.2.2 Benefits of risk management in construction projects. The benefits of adopting risk management in construction projects cannot be over-stated. This includes decreasing doubts, accomplishing construction project goals, and maximising prospects within the business environment (Okereke *et al.*, 2022). Contribution to construction project success, producing better business outcomes through more informed decision making, enhanced creative thinking, innovation, reducing overhead and time waste, and recognising uncertainty and providing forecasts of possible outcomes were identified as the major benefits of the use of risk management tools in construction projects (Belel and Mahmood, 2012). Kpodo (1989), Ebekozien and Omoh-Paul (2023), and Oke *et al.* (2023) highlighted how risk management can profit a nation's economy in all ramifications.

(1) *Nation's economy*

- The positive impact on the domestic product because of resourceful risk management will improve the country's GDP.
- The mechanism (effective risk management) will prevent or mitigate wastage of resources. In principle, foreign exchange is saved.

(2) *Individual employee*

- The mechanism ensures that the employees are efficient and productive.
- It ensures employees' safety by mitigating work-related injuries.

(3) *Business organisation*

- It is germane for improving the company's credit rating.
- It can prevent or mitigate the effect of natural disasters such as flood, fire, earthquake, etc.

2.2.3 Issues impeding adoption and implementation of risk management in construction projects. Aliyu (2013) affirmed that certain issues are responsible for lax risk management practices in Nigeria. Oke *et al.* (2023) found the absence of risk management knowledge, a lack of risk management motivation, inadequate professional and experience, competition based

on the lowest bid, improper designs, information flow breaks, and extensive subcontracting as the top-ranking encumbrances facing risk management techniques implementation. Belel and Mahmood (2012) found insufficient skilled personnel, inadequate contractor experience, new technology, changes in construction project scope and requirements, subcontractors, inadequately defined roles and duties, and design errors and lapses as the top-ranking risk sources in construction projects in Nigeria. Also, Goh and Abdul-Rahman (2013) and Zailani *et al.* (2019) found resistance to change and contractors/developers' satisfaction with the conventional system as major contributing factors to the impending adoption and implementation of risk management in projects in developing countries. Zailani *et al.* (2019) identified construction costs, tight plans, and inadequate knowledge as the major issues hindering risk management in small projects. In summary, issues impeding the adoption and implementation of risk management in construction projects are:

(1) Inadequate knowledge of risk management processes.

(2) Absence of risk management framework to link key stakeholders.

(3) Lax implementation of the concept.

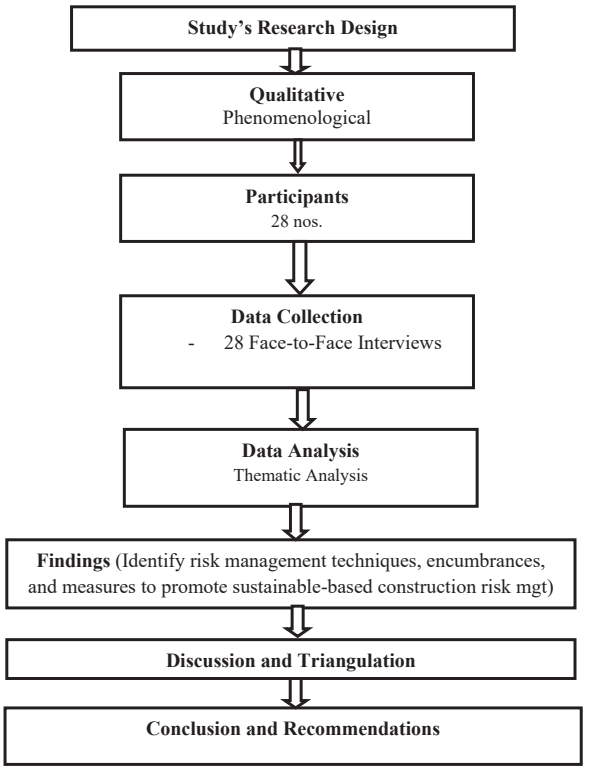
(4) Inadequate experience with project personnel.

(5) Different acknowledgement of risk control mechanisms.

3. Research method

The researchers employed a qualitative research method. It offers a mechanism for addressing the complexity of sizable scale established alteration (Ebekozien, 2020; Jaafar *et al.*, 2021; Ibrahim *et al.*, 2022). The study also adopted the phenomenology method because of its explanatory and investigative attributes through participants' data collection with experience and knowledge of risk management in turbulent times, as illustrated in Figure 1. The study utilised semi-structured face-to-face interviews with the selected interviewees who indicated interest and were interviewed. The study's participants were selected from the 2-day workshop participants, with the theme: "managing construction projects in turbulent times," organised by the Nigerian Institute of Quantity Surveyors (NIQS), held 30th to 31st August 2023, in Benin City, Nigeria. The participants came from different parts of the country and were knowledgeable regarding risk management and turbulent times. They include government policymakers and Quantity Surveyors, consultant Engineers, consultant Architects, consultant and contracting Quantity Surveyors, and construction contractors in the built environment. Twenty-eight interviewees were engaged, and saturation was achieved. The interviewees were categorised into government policymakers (P1–P2), Quantity Surveyors in government ministries/agencies/departments (P3–P5), consultant Engineers (P6–P7), consultant Architects (P8–P9), consultant Quantity Surveyors (P10–P16), contracting Quantity Surveyors (P17–P26), and construction contractors (P27–P28), as illustrated in Table 1. Majority of the participants were from Abuja and Lagos. These two cities are the hallmark of Nigerian construction activities (Ebekozien and Aigbavboa, 2021). Table 1 shows the participants' designation, rank, and years of experience. The study's main research questions were articulated in the semi-structured interview questions, as presented in Appendix. The researchers conducted a pilot interview with four participants. The interviews were from August 30th to August 31st, 2023, during the 2-day national workshop organised by the NIQS in Benin City, Nigeria, with the theme, "managing construction project in turbulent times."

The interview sessions lasted 35 min on average. Only participants who indicated interest were interviewed. Regarding ethical issues, the participants were informed with the aim and accepted to partake without coercion. The interviewees' identities were anonymous in the



Source(s): Modified from Ebekozien *et al*. (2022)

Figure 1.
The study's research design

reporting. This aligned with Aigbavboa *et al.* (2023a, b). The researchers assigned labels to the analysed data and utilised open coding approach for the data transcript. The research utilised emotion, narrative, invivo, and themeing coding methods. This is in line with Corbin and Strauss (2015). One hundred and five codes were identified and re-grouped based on frequency, occurrence, and reference. Fifteen categories were generated from the 105 codes and were re-grouped into three themes. Examples of the 105 codes include mitigate risk, transfer risk, reduce risk prospects, estimating system reliability, decision tree analysis, reactive approach, pro-active approach, multiple criteria decision, event tree analysis, fault tree, event tree, cause-and-effect diagrams, and influence diagrams Also, examples of the 15 sub-themes include the context of risk, risk identification, risk analysis, risk evaluation, risk mitigation, inadequate knowledge of risk management processes, absence of a risk management framework to link key stakeholders, lax implementation of the concept, complex tools and techniques for analysis, and inadequate experience with project personnel. Regarding validity, the study engaged an autonomous practitioner to cross-check the sub-themes and themes in cluster discussions (Ebekozien *et al.*, 2020, 2023). The collected data were analysed manually via thematic analysis and guided by prepared semi-structured questions to proffer answers to the research objectives. The researchers adopted the thematic method to understand the common pattern as previously reported. However, the research objectives aided in developing the three main themes. The themes emerged from the 15 categories (sub-themes), while the categories emerged from 105 codes.

ID	Organisation	Years of experience	Rank/designation
P1	Government policymakers	23	Ass. Director
P2		17	Unit Head
P3	Quantity surveyors in government ministries/agencies/	22	Director
P4	departments	16	Senior QS
P5		14	Senior QS
P6	Consultant engineers	28	Principal Partner
P7		26	Senior Partner
P8	Consultant architects	33	Partner
P9		26	Partner
P10	Consultant quantity surveyors	40	Principal Partner
P11		34	Director
P12		23	Partner
P13		25	Partner
P14		13	Resident QS
P15		10	Resident QS
P16		14	Partner
P17	Contracting quantity surveyors	22	Chief Estimator
P18		29	Head Pricing Unit
P19		33	Head, QS dept
P20		15	Senior QS
P21		12	Senior QS
P22		18	Cost Engineer
P23		22	Chief Site QS
P24		20	Ass. Chief Estimator
P25		26	Director, Estimating Dept.
P26		10	Site QS
P27	Construction contractors	33	CEO medium firm
P28		29	Operational Manager

Source(s): Authors work

Table 1. Interviewees' description

4. Results of the study

Turbulent times are hugely challenging for organisations, including firms in the construction industry. All things being equal, the construction industry has its high risks. These construction risks are compounded in turbulent times (majority). Participant P24 says, " . . .. *understanding the dynamics of the crisis is key to skillfully proffering solutions to prevent or mitigate the negative impact of turbulent times on construction projects* . . .." (invivo and narrative). The study identifies kidnapping, pandemics, banditry, fuel subsidy removal crisis, youth restiveness in the Niger Delta of Nigeria, inter and intra community crisis, floating of dollar currency, recessions, geometric inflation, and increased cybercrime (also known as yahoo–yahoo) as examples of turbulent times that could influence risk associated with construction projects. Objectives One, Two, and Three are addressed in Themes One, Two, and Three, respectively, as follows:

4.1 Theme one: various risk management techniques that can be used in turbulent times

The main goal of risk management techniques is to ensure timely decisions are originated to mitigate risk, transfer risk, reduce risk prospects, or reduce risk effects on construction projects. " . . .. *this is pertinent in risk management techniques because the cost of prevention is much preferable than remedying damages not prevented* . . .." said P20 (invivo). Findings reveal

that risk management techniques can be used in turbulent times that align with standard risk management processes. This includes establishing the context of risk, identifying, analysing, evaluating risks, and mitigating risks, as summarised in Table 2 (narrative). Refer to Table 2 for details of the tools and techniques associated with context establishment. Second stage is the risk identification techniques. Participant P16 says, " . . .. *at this stage, investigation about the sources of risk and potential consequences are identified, and immediate action by an expert*

Context of Risk	Risk identification	Risk analysis	Risk evaluation	Risk mitigation
Project network diagrams. E.g. critical path method and programme evaluation and review technique (majority)	Checklist: It is a traditional way to investigate symptoms of possible risk scenarios (majority) (Oke *et al.*, 2023)	Probability and impact grids: It reveals the significance of risk events (majority)	Decision tree analysis: The decision process and output are structured via a decision process (majority)	A reactive approach: It is a risk mitigation approach after risk events (majority)
Precedence diagramming method: It is an advanced form of project network diagramming that can show the relationship and overlapping of construction activities (majority)	Influence diagrams: It is a graphical representation of the structure and present uncertain events, consequences, if any, and their relationships graphically (P23 and P26)	Estimating system reliability: It is tool for exploring system elements (P2 and P18)	Portfolio management: It compares multiple construction projects regarding the risk associated with investment (P26)	Pro-active approach: An action conducted based on the probability of a risk event (majority)
Generalised Activity Networks (GAN): This is a graphical presentation of the possible tasks (P5, P12, and P23)	Cause-and-effect diagrams: It is also known as fishbone diagram and graphically represent the root causes-and-effect of issues (majority)	Fault tree analysis: It is used to establish the chance of a failure task occurring in the task (P13 and P22)	Multiple criteria decision-making method: The positive and negative variables are considered a decision-making criterion (majority)	
Design Structure Matrix (DSM): It shows the precedence relationship of construction activities (P5, P13, P22, and P28)	Fault tree: It is a visual technique used to break down failure in the system and show the cause-and-effect relationship (P22)	Event tree analysis: It determines how the event is likely to occur from the previous event (P22 and P25)		
IDEF0 Functional Modelling: This is a graphical representation of construction activities with arrows to show the flow (inputs, outputs, and controls) (P18 and P22)	Event tree: An advanced form of fault tree that reveals the potential consequences and assign to tasks (P3, P17, and P27)	Sensitivity analysis and simulation: It reflects on responses by the system as changes occur (majority)		

Table 2. Summarised techniques used at different risk management process

Source(s): Authors work

is encouraged to mitigate possible hazards . . .." The third stage is the risk analysis technique. Participant P10 says, "*. . .. that risk analysis allows the investigator to determine whether the risk event is worth further analysis. If establishing a need exists, the risk magnitude is conducted, leading to risk mitigation . . ..*" (emotion and invivo). Regarding techniques for risk analysis, findings reveal probability and impact grids, system reliability estimation, fault tree analysis, event tree analysis, and sensitivity analysis and simulation (narrative).

Risk evaluation is the fourth stage of the risk management process. The risk event is prioritised at this stage, and best and standard practices are adopted. Participant P19 says, "*. . .. A mitigation plan is generated by considering a risk event. This includes strategic and budget . . ..*" Regarding techniques for risk evaluation, findings reveal decision tree analysis, portfolio management, and multiple criteria decision-making methods as the tools and techniques associated with this stage of the risk management process, as summarised in Table 2. Risk mitigation is a key component of the risk management process. Participant P16 says, "*. . .. risk activities reduce construction project objectives when damaging impact realise because of unforeseen situations, especially in turbulent times. It becomes difficult to predict. Thus, the need for risk mitigation plan to control activities . . ..*" Concerning techniques for risk mitigation, findings reveal reactive and pro-active approaches as the tools and techniques associated with this stage of the risk management process, as summarised in Table 2.

4.2 Theme two: perceived encumbrances facing construction risk management techniques

Despite the benefits of risk management techniques, such as mitigating uncertainties and accomplishing construction project goals, especially in developing countries, including Nigeria, with perceived high turbulent times, findings reveal some factors hindering managing construction project risk in turbulent times. Nine main factors emerged from the study as the encumbrances facing construction risk management techniques in turbulent times. This includes inadequate knowledge of risk management processes, absence of a risk management framework to link key stakeholders, lax implementation of the concept, complex tools and techniques for analysis, and inadequate experience with project personnel (majority). Others are a different acknowledgement of risk control mechanisms (P3–P12), strict project schedule (P14, P19, and P24), higher construction costs affect the profit margin of developers (P14, P18, and P24), and complex tools and techniques for analysis (P15, P18, and P22). In an era of turbulent times, identifying measures to promote sustainable-based construction risk management techniques is inevitable because of the threats of risks to improving and achieving sustainable development goals linked with the construction industry, especially in developing countries, Nigeria included.

4.3 Theme three: measures to promote sustainable-based construction risk management

Sustainable-based construction risk management should be encouraged to permeate all facets and processes of the project. This is pertinent to achieving the goal of risk negotiations, evaluating the risks, and mitigating the risks to the minimum, if not preventable. To achieve this, organisations need a feasible risk and control culture mechanism (risk management plan). Thus, this sub-section presents measures to promote sustainable-based construction risk management in turbulent times. Installing a sustainable risk management plan in construction projects has become germane to understanding better the goals/missions/visions, including the contents and feasibility of the projects (majority). Ten feasible measures to promote sustainable-based construction risk management in turbulent times emerged. This includes:

(1) A new interpretative and mitigating framework has been developed for firms' risk management strategies analysis (majority).

(2) Comprehensive risk management function planning process (P15, P19, P20, and P22).

(3) Resilience and flexibility are supported with integrated mechanisms, risk assessment, and vulnerability (majority).

(4) Risk management mitigation framework of construction projects in developing countries (P3, P14, P18, P24, and P28).

(5) Innovative methodological tool via innovative organisational structures (majority).

(6) A holistic view of each type of risk and its impact on sustainability (P4, P6, P9, and P16).

(7) Technological turbulence (P1, P7, P19, and P26).

(8) Collaborative strategies (majority).

(9) Reinforce the association between risk management techniques and corporate sustainability evaluation per the 2023 Agenda (P18 and P23).

(10) Upskilling and reskilling of construction practitioners (majority).

Hence, Nigeria's public and private sectors should develop a risk management approach to address risk issues. Participant P17 is concerned about enforcement on construction projects, especially government projects, and says, " …. *do we have the capacity regarding the implementation or monitoring team to ensure the needful is done in a system that is alleged to be embedded in cancerous corruption? I'm just asking* . . .." (emotion) Also, Participant P4 says, " . . .. *if construction firms key into technological turbulence early before the construction starts, the possibility to mitigate or prevent construction risks in turbulent times should* . . .." Thus, this demands significant informed change decisions via collaboration with all stakeholders (P2, P13, P26, and P28). Participant P23 says, " …. *risk in construction cannot be eliminated, especially now that there are several turbulent crises. We should work towards having a functional risk management plan for every project and make provision for mitigation should the need arise* . . .." This is because majority is effective based on the perceived findings. Findings show that besides organising workshops/conferences to promote awareness, it can be used to upskill and reskill practitioners, especially regarding new technologies to improve risk management practices.

5. Discussion

Findings reveal establishing the context of risk, identifying, analysing, evaluating risks, and mitigating risks as risk management techniques can be used in turbulent times in line with standard risk management processes, as summarised in Table 2. Findings slightly disagree with Ahmed *et al.* (2007). Ahmed *et al.* (2007) established seven stages. This includes establishing the context of risk, identifying, analysing, evaluating, communicating, consulting across stakeholders, and monitoring and controlling risk events. Findings in the 2nd to 4th stages of the risk management process align with Ahmed *et al.* (2007) and Oke *et al.* (2023) established risk management process. Despite the benefits of risk management techniques, such as mitigating uncertainties and accomplishing construction project goals, especially in developing countries, including Nigeria, with perceived high turbulent times, findings reveal some factors hindering managing construction project risk in turbulent times. Findings agree with Aliyu (2013), Oke *et al.* (2023), and Ebekozien and Omoh-Paul (2023). Ebekozien and Omoh-Paul (2023) found that some factors are responsible for Nigeria's ineffective risk management practice. Besides, these previous studies did not cover their

studies from the perspective of turbulent times, as identified previously. Findings agree with Zailani *et al.* (2019) and Oke *et al.* (2023). Zailani *et al.* (2019) and Oke *et al.* (2023) found that construction costs, tight plans, and inadequate knowledge were the major issues hindering risk management in small projects. Also, findings slightly disagree with Dornberger *et al.* (2014). Dornberger *et al.* (2014) found risk culture resistance to be a key barrier in Australia. Others are inadequate risk management, the nature of the environment, and inadequate support from management staff.

Regarding a developed new interpretative and mitigating framework for firms' risk management strategies analysis and technological turbulence, findings agree with Ebekozien and Omoh-Paul (2023), Oke *et al.* (2023), and Ogbeibu *et al.* (2020). Oke *et al.* (2023) reported that the United Kingdom developed a comprehensive risk management approach and has mitigated project construction risks. This needs to be included in Nigeria's construction projects. In developing a risk management approach to address risk issues, findings agree with Ogbeibu *et al.* (2020) and Foli *et al.* (2022). Ogbeibu *et al.* (2020) and Foli *et al.* (2022) affirmed that technological turbulence could improve the organisation's innovation performance. Measures such as collaborative strategies and reinforcing the association between risk management techniques and corporate sustainability evaluation in line with the 2023 Agenda agree with Wang *et al.* (2004), Cangemi *et al.* (2011), and Oke *et al.* (2023). Wang *et al.* (2004), Cangemi *et al.* (2011), and Oke *et al.* (2023) found that the capabilities to systematically identify, analyse, and overcome barriers generated require commitment and inclusive leadership willing to invest valuable resources in resolving the problem. Hence, a mitigating framework or practical mitigation measures would help manage the construction project risk of developing countries.

6. Study's implications

This study on mitigating construction risk through promoting new sustainable-based construction risk management techniques in turbulent times has developed from a practical perspective. Thus, there is a need for further theoretical implications to the paucity of literature regarding identifying measures to promote sustainable-based construction risk management techniques in turbulent times in developing countries such as Nigeria. This research contributes to the body of knowledge via the methodology adopted and constructs that emerged. These perspectives would enrich the existing variables. Besides the qualitative research approach that set the study, emerging risks such as kidnapping, pandemics, banditry, fuel subsidy removal, floating of currency, recessions, geometric inflation, and cybercrime were identified as examples of turbulent times. Also, as part of the theoretical implications, the risk management techniques identified were clustered in line with standard risk management processes (Ahmed *et al.*, 2007; Oke *et al.*, 2023). This includes establishing the context of risk, identifying, analysing, evaluating, and mitigating risks. Lastly, the study identified the perceived encumbrances facing construction risk management techniques in turbulent times and solutions were proffered to mitigate or prevent these risks from causing hazards to construction activities.

Regarding implications for practices, the study would create a link between the sources of construction risk and the firm's sustainability. This includes the economic, social, and environmental aspects. These relationships contribute to developing a map of the firm's objectives' vulnerabilities, exposures, and hazards, focussing on sustainability and maintenance during turbulent times, such as COVID-19. This approach would enhance a proactive, holistic view of the risk type and the possible impact on sustainability. The COVID-19 guidelines assisted operators/safety officers in managing construction site crises (Ebekozien and Aigbavboa, 2021). Thus, a comprehensive risk management function planning process should be encouraged and embraced to manage emerging risks in

turbulent times. This has become germane because besides the sources of risk have changed, they are more interconnected, making construction firms' operations more complicated. One pertinent point that cannot be taken out from risk management is resilience and flexibility, supported with integrated mechanisms to mitigate or prevent risks (Settembre-Blundo *et al.*, 2021). These two variables are required to face turbulent times or uncertainty.

7. Study's limitations and area for further research

This study has some limitations. First, the study focused on risk associated with construction projects in turbulent times. Second, the research adopted a qualitative data collection and analysis approach. To ensure triangulation of the study's main findings, the research design, data collection, and post-data analysis were guided. For example, the adoption of a recognised pattern (semi-structured interview), comparison of findings against reviewed literature, theme approach to establish a pattern from the data, etc. It is to ensure the study's reliability, validity, and credibility. Thus, offering some potential areas for future studies. Since the study was exploratory, findings generalisation may not be suitable. The need to validate the main constructs that emerged from this study via a quantitative or mixed method approach cannot be over-emphasised. Also, developing a model via the identified measures to promote sustainable-based construction risk management techniques in turbulent times is a new area to develop further. Besides turbulent times, there are evolving risks associated with new and innovative technologies, such as green technology in the 21st century. Studies should research in this direction to identify the uncertainties and risks associated with them (Sun *et al.*, 2020).

8. Conclusion and recommendations

Risk management in developing countries, including Nigeria, especially in these turbulent times, is an important field of concern to stakeholders. This is because of its implications for the time, cost, quality, and profit of the contractor/developer. The study provides a platform to address how stakeholders in the Nigerian construction industry can achieve more gains by taking advantage of the opportunity, mitigating risk and uncertainty in turbulent times. This would increase growth, profit, and sustainability. Discussing risk management practices in the construction industry has become pertinent because of the complex procedures involved and the unique concerns and contexts linked with each construction project. Thus, this study adopted a qualitative approach, and data were collected during a two-day national workshop on managing construction projects in turbulent times organised by the NIQS, held on August 30th–31st, 2023.

The study identified kidnapping, pandemics, banditry, fuel subsidy removal crisis, youth restiveness in the Niger Delta of Nigeria, inter and intra-community crises, floating of dollar currency, recessions, geometric inflation, and increased cybercrime (also known as yahoo–yahoo) as examples of turbulent times that could influence risk associated with construction projects. Also, the risk management techniques identified were clustered in line with standard risk management processes. The study identified nine encumbrances facing construction risk management techniques in turbulent times. This is because managing construction project risks in turbulent times is germane for infrastructure development, especially in developing countries. Hence, the study recommended measures to promote sustainable-based construction risk management in turbulent times. The pinnacle is to achieve minimal risk on construction projects in turbulent times via the following recommendations:

(1) Risk management awareness still needs to improve in the current Nigerian construction industry. A "resistance to change factor in the industry" and contractors/developers' satisfaction with the conventional system are the key contributory issues to the low awareness. Therefore, besides construction companies

taking the lead in implementing risk management practices, the government should promote them by imposing them as a pre-requirement in bidding for construction projects. The outcome would promote and prove the advantages of risk management practices in construction projects, especially in turbulent times, to mitigate consequences and cost overruns. This is because turbulent times in construction projects probable will increase risk chances.

(2) Sustainable institutional and mitigation risk management framework via policies and programmes should be encouraged and embedded in the building code. This would promote risk management adoption and implementation in the industry as a company's policy. The framework would enhance communication channels. It would also benefit managing construction project risk, especially in developing countries' turbulent times, including Nigeria.

(3) Construction firms should evaluate project risks correctly and establish the most economical initiative to prevent or mitigate them. The outcome would minimise possible expenditures arising from emergencies during site construction.

(4) Upskilling and reskilling of construction practitioners, especially contracting staffers, regarding knowledge and procedures on managing construction project risks in turbulent times cannot be over-stated. Training and retraining Nigerian contracting firms' staffers in all construction phases is germane to effectively implementing risk management emphasising mitigation in turbulent times.

(5) The Nigerian construction industry, especially contracting firms, can do well by embracing the risk management process into their contract administration from the pre- to the post-construction phase, especially in this era of turbulent times. This approach would mitigate the likelihood of negative impacts from turbulent times, if any, during the construction project life cycle.

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Further reading

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Appendix

Semi-structured interview questions

Dear participant,

Request for short research interview

The construction industry is unique but with uncertainties. This is because of the operating environment. This intricacy gives rise to several construction risks and is compounded in developing countries' turbulent times. If not managed, these risks enhanced in turbulent times could negatively impact the Nigerian construction projects' cost, time, quality, and performance. Therefore, this study is titled *Managing Construction Project Risks in Turbulent Times: A Stakeholders Perspective*. Specifically, the researchers will achieve the study via the following objectives:

(1) To identify various risk management techniques in turbulent times.

(2) To investigate the perceived encumbrances facing construction risk management techniques in turbulent times.

(3) To identify measures to promote sustainable-based construction risk management in turbulent times.

The interview questions are going to be within the stated objectives. Responses provided by you will be collated and analysed with those of other interviewees. It will make up the value and contribution to achieving the success of this work. The researchers will treat the information provided with the greatest secrecy.

Hence, many thanks for your valuable time in answering the questions.

Yours faithfully,

(Coordinator)

Basic questions for the participants

(1) Please, for record purposes, what is your organisation's name and state located?

(2) Please, what is your position in the organisation?

(3) Can you tell us your years of work experience?

(4) Are you knowledgeable regarding construction risk management and turbulent times?

(5) Can you mention some of the recent turbulent times scenario as it relate to managing construction project risks?

(6) Besides Monte Carlo simulation, sensitivity analysis, risk register, brainstorming, and checklist techniques used in managing construction project risk, are there other tools/techniques you know that can be used in turbulent times? If yes, what are they?

(7) What is/are the most common tool(s)/technique(s) used by practitioners and why.

(8) Can these techniques be used to mitigate or prevent turbulent times?

(9) From your perception, can you identify the perceived encumbrances facing the use of construction risk management techniques in turbulent times?

(10) What is the most common encumbrance(s) from the identified factors and why?

(11) What are the feasible measures to improve construction risk management in turbulent times?

(12) What specific role can construction firms play in improving project risk management in turbulent times?

(13) What specific role can policymakers/relevant government agencies play in improving construction risk management in turbulent times?

(14) Would awareness via a workshop of this kind significantly improve risk management techniques in turbulent times? If yes, how?

About the authors

Dr Andrew Ebekozien obtained his PhD from the Universiti Sains Malaysia, Gelugor, Malaysia. He is the author/co-author of many peer-reviewed journal articles. Andrew Ebekozien is the corresponding author and can be contacted at: ebekoandy45@yahoo.com

Prof. Clinton Aigbavboa is a Professor in the Department of Construction Management and Quantity Surveying, University of Johannesburg, Johannesburg, South Africa. He is the author/co-author of many peer-reviewed journal articles.

Prof. Mohamad Shaharudin Samsurijan is the Dean, School of Social Sciences, Universiti Sains Malaysia, Gelugor, Malaysia. He is the author/co-author of many peer-reviewed journal articles.

Prof Mohamed Ahmed Hafez Ahmed is a Professor in the Department of Engineering, INTI International University, Nilai, Malaysia. He is the author/co-author of many peer-reviewed journal articles.

Dr Opeoluwa Akinradewo is a postdoctoral fellow in the Department of Construction Management and Quantity Surveying, University of Johannesburg, Johannesburg, South Africa. He is the author/co-author of many peer-reviewed journal articles.

Igbebo Omoh-Paul is a Contract Manager in Rainoil Limited, Asaba, Nigeria.

Author Affiliations

Andrew Ebekozien, Department of Construction Management and Quantity Surveying, University of Johannesburg, Johannesburg, South Africa; Development Planning and Management, School of Social Sciences, Universiti Sains Malaysia, Gelugor, Malaysia; Department of Engineering, INTI International University, Nilai, Malaysia and Department of Quantity Surveying, Auchi Polytechnic, Auchi, Nigeria

Clinton Aigbavboa, Department of Construction Management and Quantity Surveying, University of Johannesburg, Johannesburg, South Africa

Mohamad Shaharudin Samsurijan, Development Planning and Management, School of Social Sciences, Universiti Sains Malaysia, Gelugor, Malaysia

Mohamed Ahmed Hafez Ahmed, Department of Engineering, INTI International University, Nilai, Malaysia

Opeoluwa Akinradewo, Department of Construction Management and Quantity Surveying, University of Johannesburg, Johannesburg, South Africa

Igbebo Omoh-Paul, Rainoil Limited, Asaba, Nigeria