

Examining the Key Challenges and Barriers to Construction Risk Management Implementation during Health Pandemics

M.K.S. Al-Mhdawi^{1,2}; Abroon Qazi³; Nicholas Dacre⁴; Udechukwu Ojiako^{5,6,7} and Odai Aljaloudi^{8*}

¹*School of Computing, Engineering and Digital Technologies, Teesside University, Middlesbrough, UK.*

²*Department of Civil, Structural and Environmental Engineering, Trinity College Dublin, Dublin, Ireland.*

³*School of Business Administration, American University of Sharjah, Sharjah, UAE.*

⁴*Southampton Business School, University of Southampton, Southampton, UK.*

⁵*Department of Design, Manufacturing & Engineering Management, University of Strathclyde, Glasgow, UK*

⁶*Centre for Systems Studies, Hull University Business School, University of Hull, Hull, UK*

⁷*Johannesburg Business School, University of Johannesburg, Johannesburg, South Africa.*

⁸*School of Business, Computing and Social Sciences, University of Gloucestershire, UK.*

ABSTRACT

The purpose of this study is to identify and assess the level of significance of key risk management implementation challenges and barriers (RMICBs) in the construction industry of developing countries during the COVID-19 pandemic. To achieve this, semi-structured interviews were conducted with 30 construction experts in Iraq, including project managers, contractors, safety engineers, and academics. A total of 34 RMICBs were identified and grouped into four categories: analytical approach-related, behaviour-related, management-related, and team-related challenges and barriers. Results show that the most critical RMICBs are the complexity of quantitative-based risk assessment tools, bribery, ineffective risk communication, and insufficient familiarity with the risk management process. This research significantly enhances existing knowledge, offering construction professionals in developing countries deeper insights into the key challenges and barriers that hinder the successful implementation and delivery of risk management practices in construction projects during health pandemics.

Keywords: COVID-19 pandemic; Risk management; risk management challenges and barriers; construction industry.

INTRODUCTION

In May 2020, the World Health Organisation (WHO) declared a global health pandemic caused by the novel coronavirus disease (COVID-19) (Dryhurst et al., 2020). The pandemic and resultant public health measures posed the greatest threat to global economic growth since the Great Recession (Namian et al., 2024; Qazi et al., 2024). According to the World Bank, the global economy contracted by 4.3% as a result of the pandemic, making it one of the top four global recessions in modern history (World

The research presented in this pre-print has been submitted to the 2024 British Academy of Management Conference (BAM 2024)

Bank, 2021; Nabil et al., 2022). Such adverse effects are related to enforcing governmental regulations and measures to control the spread of the disease, such as travel restrictions, distancing measures, quarantine measures, and border controls and closures. The most fundamental barrier to economic activity was "lockdown" policies, which halted production activities and caused massive supply chain issues (Porter, 2020). As highlighted by Franzese (2020), the response of the public and private sectors to the pandemic is expected to have a profound impact on the operation and performance of various national and global markets and sectors, including construction. In fact, unlike other industries and sectors whose activities are more geared towards internet technology and intangible products, the construction industry was not able to implement telecommuting technologies to mitigate the safety concerns and productivity issues caused by the pandemic (Daniels et al., 2020). Consequently, the industry faced difficulties in maintaining safety measures while delivering projects on time. In particular, the pandemic caused many project delays and challenges due to health and safety concerns, contractual implications and claims, workforce shortages, supply chain disruptions, suspensions of construction projects, unavailability of construction materials, tools, and equipment, changes in laws, difficulties in accessing job sites, and financing pressures (Assaad and El-adaway, 2021; Al-Mhdawi, 2022; Al-Mhdawi et al., 2022a). Based on the duration and severity of the crisis in various construction markets and sectors, these challenges could continue to deepen and be felt for many years to come (PWC, 2020). Globally, the outbreak of COVID-19 has significantly affected the construction markets (Agyekum et al., 2021; Sami Ur Rehman et al., 2022; Umar, 2022; Al-Mhdawi et al., 2022b). Nonetheless, construction markets in developing countries are perceived as being more vulnerable to the effects of the pandemic and its emerging risks for the following reasons:

1. Compared to developed countries, the developing world appears to be facing higher mortality rates. The high number of positive COVID-19 cases and deaths that have occurred in developing countries is generally attributed to poor health systems, lack of public health awareness, and non-compliance with global guidelines on wearing face masks, using hand sanitiser, and social distancing, which have resulted in a significant shortage of skilled construction workers (Amoah and Simpeh, 2021; Chigara and Moyo, 2021).
2. Unlike other 21st-century outbreaks (e.g., SARS, MERS, or H1N1pdm09), the COVID-19 pandemic is of unprecedented scale and intensity (Casady and Baxter, 2020) for the construction industry worldwide, and for developing countries in particular. In fact, the impact of the COVID-19 pandemic on the construction industry of developing countries was reported by several studies to have similar characteristics and behaviours, leading to changes in laws, business closures, suspension and termination of construction contracts, and associated difficulties experienced by developers, contractors, and vendors (Agyekum et al., 2021; Olatunde et al., 2021). Moreover, the

effect of the pandemic on developing countries has caused significant challenges to the labour market that outweighed the effects of the Great Recession (OECD, 2020). Among the challenges workers face are not receiving their due wages from their employers, losing their jobs, being unable to access new employment opportunities, and not having adequate social protection (Walter, 2020).

The profound impact of the COVID-19 pandemic on the global economy, particularly within the construction industry, underscores the critical need for effective risk management (RM) practices (Al-Mhdawi et al., 2022c; Al-Mhdawi et al., 2023a). The pandemic has introduced a myriad of unforeseen challenges and risks, from project delays and supply chain disruptions to workforce shortages and safety concerns. In this context, RM emerges not just as a strategic tool but as an essential framework for navigating the complexities and uncertainties brought about by such global crises. Effective RM practices offer a pathway for construction companies to identify, assess, and mitigate the wide range of risks associated with the pandemic, thereby enhancing their resilience and ability to maintain operations under adverse conditions (Al-Mhdawi et al., 2023b). Despite its reported benefits, the perceived value of RM in developing countries remains minimal. This scepticism about the tangible outcomes of implementing effective RM within the construction sector has deterred senior management from embracing a consistent RM approach and investing in RM initiatives. As a result, the industry suffers from poor risk management practices (Ferede et al. 2020), facing numerous challenges and barriers to its efficacy (Boadu et al. 2020).

The available studies have predominantly either: (1) addressed the impact of the pandemic from a broader perspective, or (2) focused on specific construction themes/operations such as health and safety, legal implications, and supply chain operations. For instance, Alsharif et al. (2021) investigated the early adverse effects and opportunities of the COVID-19 pandemic on the construction industry in the United States using expert interviews. Ling et al. (2022) examined how COVID-19 affected construction demand, output production, prices, and project performance using a survey, published statistical data analysis, and conducting in-depth expert interviews. Another example is the work of Stiles et al. (2020), who investigated the impact of COVID-19 on health and safety in the construction sector using a literature review. Moreover, Salami et al. (2021) analysed the methods and practices adopted by construction companies in the United Kingdom to mitigate the risk of litigation resulting from potential contract breaches due to COVID-19, based on descriptive statistics, exploratory factor analysis, and reliability analysis. Furthermore, Amoah and Simpeh (2021) examined the challenges faced by construction firms in implementing COVID-19 safety measures on construction sites using a qualitative survey (open-ended questions). The current body of literature falls short in identifying and assessing the implementation challenges of risk management practices in the construction industry of developing countries. To this end, this research attempts to fill this knowledge gap by considering the

case of the Iraqi construction industry. Accordingly, the aim of this study is to identify and assess the level of significance of the key risk management implementation challenges and barriers (RMICBs) during the COVID-19 pandemic.

METHODOLOGY

The authors conducted semi-structured interviews with Iraqi construction experts to identify the key risk RMICBs facing construction projects during the COVID-19 era. Semi-structured interviews are highly effective in obtaining insights from participants in order to explain or explore complex phenomena or problems, and it provides reliable and comparable qualitative information (Galletta and Cross 2013). This type of interview consists of a series of prepared questions, with the interviewer allowing time for the interviewees to elaborate and explain concepts through the use of open-ended questions. To this end, the authors used this method to identify the main challenges and barriers facing construction project RMICBs during the COVID-19 pandemic, and to assess the level of significance on a Likert scale from 1 (very low) to 5 (very high). In order to identify any potential limitations or weaknesses within the interview questions, the authors conducted a pilot study with construction experts in Iraq. There were five participants in the pilot study, each of whom has over 15 years of construction experience and works for the Iraqi Ministry of Construction, Housing and Municipalities and Public Works, and the private construction sector. Ultimately, the authors revised and enhanced the questions for the semi-structured interviews in light of feedback and suggestions from the participants of the pilot study. Table 1 presents the profiles of the pilot study participants.

Table 1. Profiles of the pilot study participants

No. of interviewees	Role	Range of experience (years)	Educational Level		
			BSc	MSc	PhD
2	Project managers	19-28	2	-	-
1	Consultant and academic	25	-	1	-
1	Contractor	22	1	-	-
1	Safety engineer	15	1	-	-

Interview Process

To approach experts, the authors used previous contacts with several directors and managers at the Iraqi Ministry of Construction, Housing and Municipalities and Public Works, and heads of civil engineering departments at several public universities in Iraq. In addition, the authors identified construction experts and academics and located them using LinkedIn and other social media platforms. To this end, the authors identified 57 potential participants. However, additional selection criteria were developed by the authors to sifter the potential participants on the basis of previous studies such Abdul Nabi and El-adaway (2021) and Al-Mhdawi et al. (2024). The selection criteria included (1) working in the Iraqi

construction industry and/or engineering management education (2) having at least 15 years of experience in construction engineering and management, (3) being active members of Iraqi Engineers Union and/or registered contracting companies at the Iraqi Ministry of Trade, and (4) being active members of international professional bodies like Association for Project Management, American Society of Civil Engineering, or institution for Civil Engineers. Ultimately, the authors selected 30 construction experts and academics for the interviews. Upon completion of interviews, one of the authors, who is a native Arabic speaker and fluent in English, translated the transcripts from the local language (Arabic) to English. Then, a manual content analysis was performed to identify the main study factors. In content analysis, key information is extracted from verbal, written, or video files, either quantitatively or qualitatively (Krippendorff 2018). This method is highly effective in organising and analysing information within documentary data and has been employed extensively in previous construction engineering and management research. In this research, the key factors were identified and sorted in a constructive way during the analysis process. Furthermore, the authors reviewed the recorded material again to capture the comprehensiveness and details of the recorded materials.

RESULTS AND DISCUSSION

Participants' profile

As mentioned previously, the authors interviewed 30 construction experts in Iraq, including project managers, contractors, safety engineers, and academics. A number of the participants in this study were from the upper management levels of their organisations and were involved in the construction and management of large-scale projects in Iraq. Results of the analysed participants' demographics revealed that approximately 60% of respondents reported possessing 16-25 years of experience, whereas 23.33% possessed more than 25 years of experience, followed by 16.67% with 6 to 15 years of experience. Additionally, a notable proportion of survey participants had diverse academic qualifications, with 76.67% holding a bachelor's degree, 10% possessing a master's degree, and 13.33% holding a doctoral degree. The profiles of the interviewees are presented in Table 2.

Table 2. Profiles of the Semi-Structured Interview Participants

No. of interviewees	Construction role	Range of experience (years)				Educational Level		
		1-5	6-15	16-25	<25	BSc	MSc	PhD
13	Project managers			9	4	10	2	1
8	Contractors		5	3	-	8	-	-
6	Safety engineers			5	1	5	1	-
3	Academics			1	2	-	-	3

Identified risk management implementation challenges and barriers

Following the completion of the interviews, the authors were able to identify 34 RMICBs and grouped them under four categories, namely analytical approach-related, behaviour-related, management-related, and team-related challenges and barriers. Figure 1 shows the identified RMICBs and their categories.

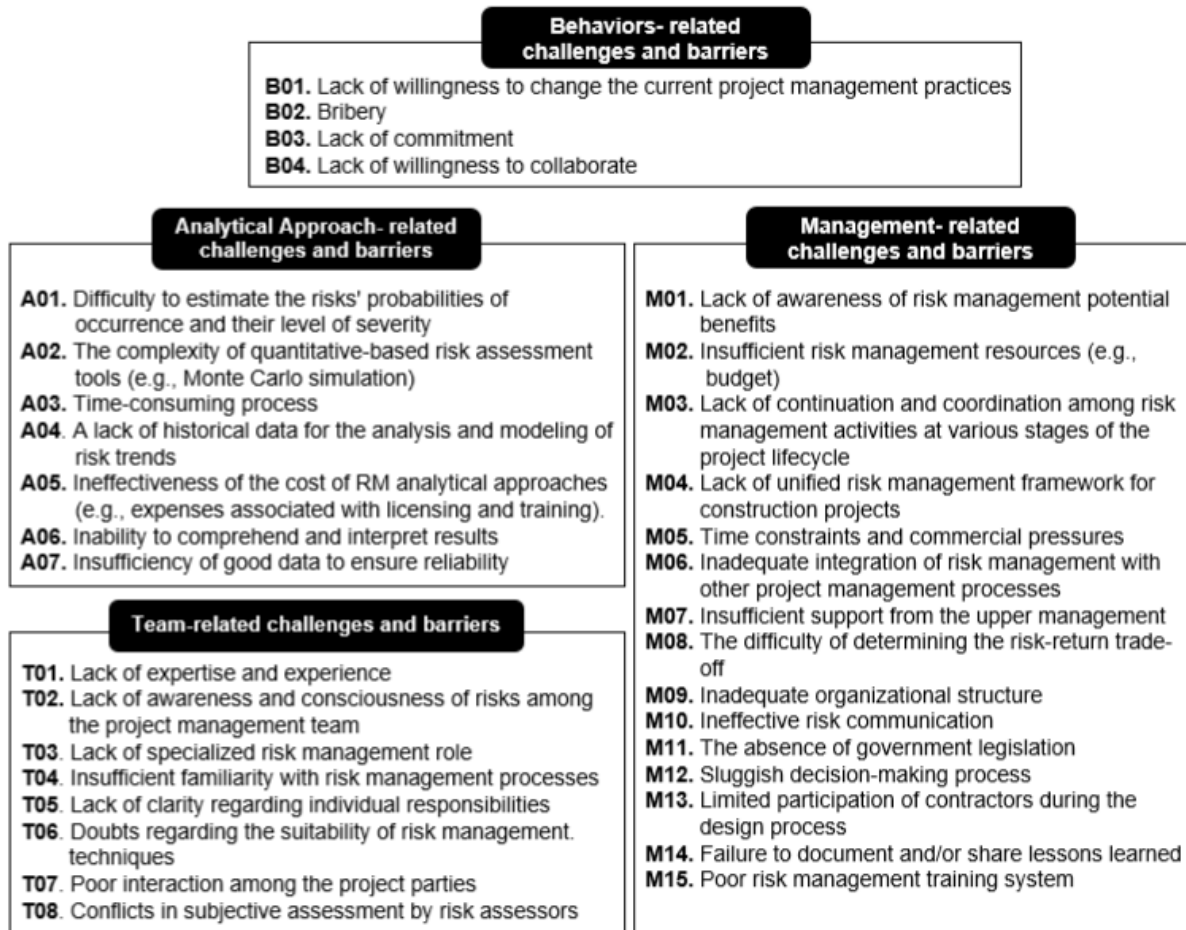


Figure 1. Identified Construction RMICBs

The following sections discuss the three most critical RMICBs in each category based on the outputs from the interviews:

1. Analytical Approach-related Challenges and Barriers

a. Complexity of quantitative-based risk assessment tools

The complexity of quantitative-based risk assessment tools (A02) refers to the complexity of using quantitative risk assessment tools when addressing numerous variables of extreme conditions, such as COVID-19. A02 was perceived by the AHP-survey respondents as a significant challenge to the effective implementation of construction RM practices during the COVID-19 era. A02 was ranked first

in the analytical approaches category. The following quotes reflect the impression of many of the interviewees:

“The complicated mathematical methodologies involved in risk assessment and forecasting, as well as some of the risk management software requirements and limitations, make it challenging for decision-makers to utilise the results and methodologies of these approaches and continue to make decisions based on personal experience and intuition; in addition, in some cases, complicated methodologies prompted some decision-makers to completely disregard risk management processes”.

The interviewee quotes below adequately convey the current practices and needs:

“Due to the various variables involved with the COVID-19 pandemic and the many sources of uncertainties associated with it, the current risk assessment analytical approaches are ineffective at capturing all dimensions of the risk analysis [...]. There are no historical data available for COVID-19's impact on the construction industry, thus making it difficult to quantify uncertainties and risks. There is a need to develop methods that are flexible to incorporate new variables and dimensions, easy to work out mathematically”.

b. Time-consuming process

Time-consuming process (A03) refers to the effort required for (1) planning for risk management and understanding the parameters and constraints associated with the RM process; (2) identification of risks, including conducting interviews and focus groups or workshops with experts to identify risks and the process of content analysis of the outputs; (3) analysis of risks, including the understanding of analytical methodologies, quantitative or qualitative, and the interpretation of the analysis results; (4) response to risks, including the preparation of feasibility studies of cost-effective measures and their potential impacts on project objectives (time, cost, and quality), and (4) monitoring and controlling of risks, including the establishment of risk monitoring mechanism depending on the nature of the project and the availability of resources. The ranking of A03 was second in the analytical approaches category.

Most of the interviewees stressed the direct effect of A03 on the effective implementation of construction RM processes during extreme conditions such as COVID-19. For example, one of the interviewees, who is a professor of risk management and consultant, had this to say:

“When you have a large number of variables bound to different constraints, it requires a great deal of computation and effort to find effective risk measures, especially when dealing with complex projects with deep uncertainties, as in the case of COVID-19 pandemic”.

Moreover, respondents highlighted that the adoption of time-efficient tools and techniques for managing project risks, together with properly archiving historical risk data from previously completed construction projects, could result in substantial time savings.

c. Ineffectiveness of the cost of RM analytical approaches

Ineffectiveness of the cost of RM analytical approaches (A05) refers to the high cost of utilising RM analytical techniques for construction projects. A05 was ranked third in the analytical approaches category. The following quote describes the impressions of many interviewees:

“The costs associated with the use of RM analytical approaches, such as purchasing software licenses and conducting training sessions outside of Iraq, have been the primary reasons for not implementing risk management and assessment methodologies and instead relying on the judgments and intuition of the stakeholders involved”.

In addition, one of the interviewees, who is an experienced project manager, had this to say:

“Unfortunately, the majority of construction projects in Iraq do not include a budget for risk management and investing in the transition of qualitative-based to quantitative-based decisions is viewed as an unnecessary cost by the majority of decision-makers”.

Furthermore, the same expert stated:

“I believe that the time has come to move beyond the old management methodologies and invest in an approach that quantifies the various uncertainties and risks that may arise during extreme conditions, such as the COVID-19 pandemic [...]. Complete reliance on the subjective judgment will only result in cost and time overruns”.

2. Behaviour-related Challenges and Barriers

a. Bribery

In the construction and engineering field, bribery (B02) is a widespread form of corruption and is considered to be more prevalent than in any other fields (Nordin 2011). The ranking of B02 was first in the team-related category. The following quote describes the impression of one of the interviewees who is a project manager in the public sector:

“Bribery has unfortunately infiltrated many aspects of the Iraqi construction industry. For example, the adoption of effective RM processes and methodologies is not in the interests of many stakeholders in the construction industry. In fact, it can sometimes be advantageous for corrupt stakeholders to not adopt the RM processes and methodologies”.

In addition, a contractor and a CEO in the private sector has this to say:

“Bribery is more common in the public sector. This is because of the involvement of numerous stakeholders, high capital costs, and poor cost control measures”.

Moreover, the following statement describe the impression of many interviewees:

“Sadly, the COVID-19 pandemic created a conducive environment for bribery in the construction industry, as project parties exploited such extreme conditions for their own personal gain. Examples include the selection of contractors, the processing of work permissions and the issuance of work certificates without meeting the specifications of the implemented work”.

b. Lack of willingness for collaboration

Lack of willingness for collaboration (B04) refers to the unwillingness to share information, teamwork engagement, and fulfilling expectations. B04 was ranked second in the behaviour-related category and third. The interviewed experts emphasised the importance of B04. One of the several interviewees with the same concerns mentioned that:

“The lack of collaboration between the contract parties (i.e., the project manager, on behalf of the client/owner, and the contractor) and those within the project manager and contractor teams can have many adverse consequences, the most important of which is the lack of trust among team members or between teams”.

In a similar vein, the following quote describes the impression of one of the interviewees who is a project manager in the public construction sector:

“Lack of willingness for collaboration can be disadvantageous due to a lack of trust, but team management can contribute to its prevention. Team leaders may determine clear expectations for the group as a whole, followed by expectations for individual members”.

Additionally, the interviewees stressed the importance of establishing a solid culture of collaboration in the construction industry in Iraq. In fact, one of the interviewee who is a project manager in the public sector had this to say:

“Creating a framework for collaboration among stakeholders to capture the key collaborative drivers such as the assessment of the present processes and the development of feedback systems is critical to ensuring the survival of construction projects under extreme conditions, such as the COVID-19 pandemic”.

c. Lack of willingness to change the current project management practices

Lack of willingness to change the current project management practices (B01) refers to the culture and organisational structure that hinder change and the lack of executive support and active sponsorship. Barkley (2004) stressed that the challenge for an organisation is to educate and train project managers

and team members to think in terms of risk as well as to internalise the risk management process into their daily routines. The ranking of B01 was third in the team-related category. Most of the interviewees stated that B01 is one of the most defining characteristics of the Iraqi construction industry. In addition, the experts have stated that management practices are similar to those employed before the COVID-19 pandemic.

Moreover, the experts stressed the necessity of adopting new management practices and methodologies that are empirically proven. In fact, the following quote describes the impression of a contractor in the private construction sector:

“It is now the time for construction decision-makers and stakeholders to sit down together to thoroughly examine the barriers and limitations of current practices, address these issues, and broaden the scope of existing practices to equip the construction industry for future extreme conditions”.

3. Management-related Challenges and Barriers

a. Ineffective risk communication

Ineffective risk communication (M10) refers to the ineffective supply of information for team members to make informed, independent judgments regarding risks. M10 was ranked first in the management-related category. The following quote describes the impression of a contractor in the private sector:

“A poorly designed risk communication process may result in incorrect interpretation of the scientific evidence regarding project success and missed opportunities to develop strategic capabilities regarding the larger-scale dimensions of the pandemic and its emerging risks”.

The following quote from a project manager who works in the public construction sector demonstrates current practices and needs:

“In practice, it has been proven that ineffective risk communication contributes to time and cost overruns. It is different when you work under high levels of uncertainty caused by the pandemic, and you have to deal with new sets of risks that are unfamiliar to experts [...]. I do not think the construction industry in Iraq utilises a system of risk communication [...]. There is an urgent need to develop such a system for risk communication during pandemics because many of the projects are urgently needed (for example, hospitals and testing/vaccination centers) and are driven by strict budgets”.

b. Inadequate integration of RM with other project management processes

Inadequate integration of RM with other project management processes (M06) refers to the lack of integration of risk management processes into the main phases of the project lifecycle (i.e., planning, design, execution/implementation, and delivery and maintenance). M06 was ranked third in the team-related category. Most interviewees indicated that in the COVID-19 era, they encountered the main challenges during the transition towards the integration of RM processes into project phases, including a lack of experience and a lack of upper management support and commitment.

In addition, a project manager in the private sector stated the following:

“Risk management practices are mostly applied during the project implementation phase. Because of high implementation costs and commercial pressures, RM procedures are not applied effectively. Whereas if it was used in the pre-implementation phase, the outcomes would be much more positive. Yet, if RM practices were adopted in the pre-implementation phase, the level of risks and uncertainties would be considerably lower in subsequent project phases”.

The following quote describes the impression of a contractor in the private sector:

“It is more common to conduct risk management methodologies periodically rather than continuously throughout project phases [...]. Unfortunately, the integration of RM into other project management processes when implementing projects during the COVID-19 era is not effective due to the poor overall level of readiness of RM; the poor integration culture of projects in Iraq; and the high level of uncertainties faced by construction projects along with the urge to make fast deterministic decisions, resulting in the decision process being based on weak grounds”.

4. Team-related Challenges and Barriers

a. Insufficient familiarity with RM process

Insufficient familiarity with the RM process (T04) refers to the lack of knowledge about the logical processes of the risk management process and its standards (e.g., BS 31100 and ISO: 31000) and professional guidelines (e.g., the project management body of knowledge by project management institute). M06 was ranked first in the team-related category and sixth overall. In this regard, an interviewee who is a professor of risk management and consultant had this to say:

“One of the most prominent impressions that construction practitioners have about risk management is its analysis. A majority of them believe that risk management refers to assessing risks and ranking them. The process, however, is more comprehensive. Ranking risks provide a good indication to decision-makers as to how they should respond to these risks. There is poor understanding by industry decision-makers of risk planning (risk management content establishment), risk identification, risk response, and monitoring and controlling. Without these processes, risk management is of little value”.

In addition, the following quote reflects the opinions of a project manager who works in the public construction sector:

“During the COVID-19 era, I believe that risk management is the weakest link in the construction project management chain [...]. The process is not understood sufficiently, and priorities have not been established to effectively incorporate into the project life cycle since there are other issues in Iraq besides the pandemic effect, such as political and economic instabilities [...]. I think investing in adopting risk management processes in the Iraqi construction industry is worth its weight in gold”.

b. Lack of expertise and experience

Lack of expertise and experience (T01) refers to the lack of knowledge of the practical implementation of RM processes and the unavailability of skilled personnel for managing project risks. T09 was ranked third in the team-related category. The following quote describes the impressions of one of the many experts:

“In the COVID-19 era, it is extremely important for the construction industry to have the experience and expertise to manage the dynamic COVID-19 emerging risks. In this regard, there are numerous constructions needs, such as hospital construction, expansion, and maintenance. Unfortunately, in Iraq, there is a lack of expertise in risk management. As a result, this presents a major challenge as it has a direct impact on the delivery of infrastructure projects on time. Now, the industry stakeholders have begun to consider risk management in an effective manner”.

c. Conflicts in subjective assessment by risk assessors

Conflicts in subjective assessment by risk assessors (T08) refers to the disagreement between construction practitioners concerning risk decision making, where decisions are made based on intuition, experience, and engineering judgment. Among the examples are conflicts in risk priorities and risk response strategies selection. T08 was ranked second in the team-related category. The following quote describes the impressions from one of many of the experts.

“Despite the importance of human input, when managing projects risks under extreme conditions, such as the COVID-19 pandemic, the data on which decisions are made may not be accurate and complete, leading decision-makers to rely completely on their engineering experience and judgment, thereby resulting in conflicts in decision making”.

In addition, the interviewees discussed the absence of formalised methodologies to utilise experts' judgment in the management of project risks and expressed the need to adopt methodologies that effectively control the level of ambiguity and uncertainty when making risk-related decisions. In fact, one of the interviewees, who is a contractor in the private sector, had this to say:

“The use of some well-established methodologies, such as AHP and fuzzy logic that can quantify the uncertainty of subjective judgments is greatly needed for the construction industry during and after the COVID-19 pandemic”.

CONCLUSIONS

This study investigated the key challenges and barriers to effective RM in the construction industry of developing countries by considering the case of Iraq, through semi-structured interviews with 30 Iraqi construction experts. Based on the adopted methodology, the authors identified a total of 34 RMICBs grouped under four categories: analytical approach-related, behaviour-related, management-related, and team-related challenges and barriers. The results indicated that the three most significant analytical approach-related RMICBs during the COVID-19 era were the complexity of quantitative risk assessment tools, the time-consuming nature of the process, and the ineffectiveness of the cost of RM analytical approaches. In terms of behavioural barriers and challenges, the results revealed that the three most significant RMICBs were bribery, a lack of willingness for collaboration, and a reluctance to change current project management practices. Furthermore, the results indicated that ineffective risk communication, the absence of a unified RM framework for construction projects, and inadequate integration of RM with other project management processes were the three most significant management-related RMICBs. Finally, the results showed that insufficient familiarity with the RM process, a lack of expertise and experience, and the conflict arising from the subjectivity of risk assessors were the three most significant team-related RMICBs. The key conclusions of this research can be summarised as following:

1. Unlike other 21st-century outbreaks (e.g., SARS1, MERS2, or H1N1pdm09), the COVID-19 pandemic is of unprecedented scale and intensity for the construction industry worldwide, causing supply chain disruptions, workforce restrictions, and legislative changes. However, the construction industry in developing countries like Iraq is perceived to be more vulnerable to the challenges associated with the pandemic. Moreover, the ongoing challenges facing the construction industry in developing countries, such as the limited use of technology, skills shortages, lack of training, lack of investment, lack of culturally appropriate procurement methods, poor health and safety systems, and a lack of government support, have played a significant role in amplifying the risk of COVID-19 pandemic (and public health measures), causing an adverse effect on the success of construction projects.
2. Risk management provides a structured framework for systematically guiding the process of managing unwanted events that would otherwise be overlooked. In the construction context, this process plays a vital role in improving communication among the team members, maximising the

effective use of resources, discouraging the acceptance of financially unsound construction projects, reducing the instability of construction activities, preserving contracting firms' credibility and reputations, and improving decision-making processes. In extreme conditions such as the COVID-19 pandemic, RM becomes even more crucial, particularly in developing countries that are characterised by a poor latent project management culture. Despite the willingness of stakeholders to consider RM effectively in Iraq, without proper RM practices and the timely implementation of risk mitigation strategies, and without a strong commitment on the part of all project parties, Iraq may be regarded as one of the developing countries with the poorest construction risk management practices.

3. Based on the findings of this study, it can be concluded that the most significant challenges and barriers affecting RM practices in Iraq during the COVID-19 pandemic are not partial challenges (micro-challenges), but rather structural challenges (macro-challenges), which can be grouped into four categories of challenges and barriers: analytical approach-related, behaviour-related, management-related, and team-related challenges and barriers.

Implications, limitations, and further work

This research significantly contributes to the body of knowledge by aiding construction practitioners and researchers in better understanding the challenges and barriers that hinder the effective implementation of risk management strategies for construction projects during extreme conditions, such as the COVID-19 pandemic. Furthermore, it offers valuable information to decision-makers regarding the current key challenges and barriers facing the implementation of construction risk management in developing countries, such as Iraq. In fact, the results of this research could serve as a baseline for construction companies and governments to develop effective strategies to address these challenges and barriers and enhance the practices of risk management. Despite its contributions, this study has some limitations. Firstly, the research relies on the judgement of experts through interviews, suggesting that incorporating other methods such as case studies could complement the results obtained. Secondly, the study has identified only 34 RMICBs across four categories, indicating that additional RMICBs should be identified and categorised. For future research, the findings of this study can be employed by scholars to analyse the level of significance of the identified RMICBs, develop RM guidelines and response strategies for their implementation challenges and barriers, and investigate the RM implementation challenges and barriers as well as the level of RM practices in developing versus developed countries, all without the need for enumeration.

REFERENCES

- Abdul Nabi, M., & El-adaway, I. H. (2021). Understanding the key risks affecting cost and schedule performance of modular construction projects. *Journal of management in engineering*, 37(4), 04021023.
- Agyekum, K., Kukah, A. S., & Amudjie, J. (2021). The impact of COVID-19 on the construction industry in Ghana: the case of some selected firms. *Journal of engineering, design and technology*, 20(1), 222-244.
- Al-Mhdawi, M. K. S., Brito, M. P., Abdul Nabi, M., El-Adaway, I. H., & Onggo, B. S. (2022b). Capturing the impact of COVID-19 on construction projects in developing countries: A case study of Iraq. *Journal of management in engineering*, 38(1), 05021015.
- Al-Mhdawi, M. K. S., Brito, M. P., Onggo, B. S., & Rashid, H. A. (2022a). Analyzing the impact of the COVID-19 pandemic risks on construction projects in developing countries: case of Iraq. In *Construction Research Congress 2022* (pp. 1013-1023).
- Al-Mhdawi, M. K. S., Brito, M., Onggo, B. S., Qazi, A., & O'Connor, A. (2024). COVID-19 emerging risk assessment for the construction industry of developing countries: evidence from Iraq. *International Journal of Construction Management*, 24(7), 693-706.
- Al-Mhdawi, M. K. S., Brito, M., Onggo, B. S., Qazi, A., O'connor, A., & Namian, M. (2023a). Construction risk management in Iraq during the COVID-19 pandemic: challenges to implementation and efficacy of practices. *Journal of Construction Engineering and Management*, 149(9), 04023086.
- Al-Mhdawi, M. K. S., Brito, M., Onggo, B. S., Qazi, A., O'Connor, A., Ayyub, B. M., & Chan, A. P. (2023b). A structural equation model to analyze the effects of COVID-19 pandemic risks on project success: Contractors' perspectives. *ASCE-ASME Journal of Risk and Uncertainty in Engineering Systems, Part A: Civil Engineering*, 9(3), 05023003.
- Alsharif, A., Banerjee, S., Uddin, S. J., Albert, A., & Jaselskis, E. (2021). Early impacts of the COVID-19 pandemic on the United States construction industry. *International journal of environmental research and public health*, 18(4), 1559.
- Amoah, C., & Simpeh, F. (2021). Implementation challenges of COVID-19 safety measures at construction sites in South Africa. *Journal of facilities management*, 19(1), 111-128.
- Araya, F. (2021). Modeling the spread of COVID-19 on construction workers: An agent-based approach. *Safety science*, 133, 105022.
- Assaad, R., & El-Adaway, I. H. (2021). Guidelines for responding to COVID-19 pandemic: Best practices, impacts, and future research directions. *Journal of management in engineering*, 37(3), 06021001.
- Boadu, E. F., Wang, C. C., & Sunindijo, R. Y. (2020). Characteristics of the construction industry in developing countries and its implications for health and safety: An exploratory study in Ghana. *International journal of environmental research and public health*, 17(11), 4110.
- Casady, C. B., & Baxter, D. (2020). Pandemics, public-private partnerships (PPPs), and force majeure| COVID-19 expectations and implications. *Construction management and economics*, 38(12), 1077-1085.
- Chigara, B., & Moyo, T. (2022). Factors affecting the delivery of optimum health and safety on construction projects during the covid-19 pandemic in Zimbabwe. *Journal of engineering, design and technology*, 20(1), 24-46.
- Dryhurst, S., Schneider, C. R., Kerr, J., Freeman, A. L., Recchia, G., Van Der Bles, A. M., ... & Van Der Linden, S. (2022). Risk perceptions of COVID-19 around the world. In *COVID-19* (pp. 162-174). Routledge.
- Elbarkouky, M. M., Fayek, A. R., Siraj, N. B., & Sadeghi, N. (2016). Fuzzy arithmetic risk analysis approach to determine construction project contingency. *Journal of construction engineering and management*, 142(12), 04016070.
- Ferede, Y. S., Mashwama, N. X., & Thwala, D. W. (2022). Theoretical study of the cost of poor risk management in the construction industry. *Proc. Int. Struct. Eng. Constr*, 9(2), 1-6.
- Franzese, N. P. (2020). Potential impacts of the coronavirus pandemic on construction projects. *The National Law Review*, 10(78), 1-2.
- Krippendorff, K. (2018). *Content analysis: An introduction to its methodology*. Sage publications.
- Ling, F. Y., Zhang, Z., & Yew, A. Y. (2022). Impact of COVID-19 pandemic on demand, output, and outcomes of construction projects in Singapore. *Journal of management in engineering*, 38(2), 04021097.
- Nabil, F. R., Namian, M., Shukes, J., Batie, D., & Al-Mhdawi, M. K. S. (2022). COVID-19 vaccine acceptance among construction workers. In *ASC2022. 58th Annual Associated Schools of Construction International Conference* (pp. 56-64). EasyChair.

- Namian, M., Nabil, F. R., Al-Mhdawi, M. K. S., Kermanshachi, S. S., & Nnaji, C. (2024). Postpandemic Era: Investigating the Impact of COVID-19 on Construction Workers' Situational Awareness. *Journal of Construction Engineering and Management*, 150(9), 04024103.
- Olatunde, N. A., Awodele, I. A., & Adebayo, B. O. (2022). Impact of COVID-19 pandemic on indigenous contractors in a developing economy. *Journal of Engineering, Design and Technology*, 20(1), 267-280
- Porter, R. (2020). 3 ways to manage the impact of COVID-19 in the construction industry.
- Qazi, A., Simsekler, M. C. E., & Al-Mhdawi, M. K. S. (2024). From prevention to response: A holistic exploration of factors shaping Global Health Security. *Progress in Disaster Science*, 100344.
- Sami Ur Rehman, M., Shafiq, M. T., & Afzal, M. (2022). Impact of COVID-19 on project performance in the UAE construction industry. *Journal of Engineering, Design and Technology*, 20(1), 245-266.
- Stiles, S., Golightly, D., & Ryan, B. (2021). Impact of COVID-19 on health and safety in the construction sector. *Human factors and ergonomics in manufacturing & service industries*, 31(4), 425-437.
- Umar, T. (2022). The impact of COVID-19 on the GCC construction industry. *International Journal of Service Science, Management, Engineering, and Technology (IJSSMET)*, 13(2), 1-17.
- Walter, D. (2020). Implications of Covid-19 for labour and employment in India. *The Indian Journal of Labour Economics*, 63(Suppl 1), 47-51.