

Contents lists available at ScienceDirect



Journal of King Saud University – Engineering Sciences

journal homepage: www.sciencedirect.com

Original article

Financial risk management in the construction projects

Abdussalam Shibani*, Dyaa Hasan, Jalal Saaifan, Heba Sabboubbeh, Mohamad Eltaip, Messaoud Saidani, Nawal Gherbal

School of Energy, Construction and Environment, Coventry University, CV1 5FB Coventry, UK

ARTICLE INFO

Article history:

Received 2 March 2021

Accepted 6 May 2022

Available online xxx

Keywords:

Risk Management (RM)

Risk in construction

Significant risks

Construction projects

Lebanon

ABSTRACT

Construction risk can be described as the possibility of an incident that will harm the project's feasibility. Different threats that impact businesses may be found in the construction industry as elsewhere. Moreover, construction projects face significant risks that put building projects at the risk of cost, over time, and poor standard of execution. In the last two years, Lebanon has been suffering from a severe economic crisis, which has affected a large number of businesses and industries, specifically the construction industry. Therefore, this article aims to identify, classify and analyse the most significant risks inherent in the Lebanese construction industry with special emphasis on the financial and economic risk category and eventually establish a conclusion in this regard. To achieve the aims of this research, the data were collected by conducting a questionnaire survey among experts in the Lebanese construction industry. The results showed that the construction industry in Lebanon is exposed to many risk sources, internal and external, and the most important ones are financial risks such as fluctuation of the currency, inflation, and lack of solvency. Finally, the importance and benefits of implementing risk management are discussed in this research as well as the barriers to its effective implementation.

© 2022 The Authors. Production and hosting by Elsevier B.V. on behalf of King Saud University. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

1. Introduction

Interpretation of various law codes and regulations is essential within construction processes; however, it also requires the collection of significant resources such as human resources, equipment, and materials. Moreover, good communication between the parties is important in every construction project. Additionally, diverse factors may be unknown at the beginning of the project, but the risk is an anticipated element of this business. In construction projects, risks are defined as the probability of an event that may negatively affect the life cycle or the schedule of the project and will expose the project to a viable loss. Various damaging consequences may occur on the project because of risks and uncertainty (Flanagan et al., 2006). The project success is correlated with three major aspects of cost, time, and quality where risks cannot be eliminated but can be effectively managed. Numerous risks that affect the pro-

ductivity of the work can be recognised in construction projects. However, those risks differ between projects; to assure the wealth of any project, the contractor must identify and allocate those risks to be able to manage them at an early stage of the project, where the purpose of effective risk management is to reduce risk exhibition and it's a cost in construction projects (see Table 1).

As stated by Abrahamson (1984), to reduce the negative impact and to increase productivity and effectiveness, appropriate risk allocation and identification are a must. However, there seems to be more serious risks following the participation of numerous parties in the project, all linked to the political, socio-cultural, and economic differences of the location where the construction is taking place. However, this study focuses more on the economic and financial risks in construction, which are one of the most important risks (Antonio, 2011); moreover, the integrated economy of the world creates many risks for the industries where financial risk is the most complex one. The Lebanese economy had not had the option to flourish as Lebanon has been going through restoration since the 15-year war (1975–1990) that destabilised the economy. However, Lebanon has demonstrated a major construction explosion in the last few years. As stated by Frans bank, the GDP growth in Lebanon was estimated to increase by 7 to 8 percent in 2018, and the study indicates an increase in the private and public investments in Lebanon. However, because of the CEDRE donor of 11.8 billion USD as economic support of which 11 billion USD

* Corresponding author.

E-mail address: ab1732@coventry.ac.uk (A. Shibani).

Peer review under responsibility of King Saud University.



Production and hosting by Elsevier

<https://doi.org/10.1016/j.jksues.2022.05.001>

1018-3639/© 2022 The Authors. Production and hosting by Elsevier B.V. on behalf of King Saud University.

This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Table 1
The sources of risk factors and barriers to implementing RM.

Risk Factors	Sources
Risk of war	Strour et al. (2010)
Pandemic risk	Jones et al. (2008)
Corruption in the Lebanese construction sector	Mezher and Tawil (1998) and Kenny (2009)
Political Corruption	El-Sayegh (2008)
Delayed Payments to contractors	Onengiyefori (2016)
Design change	Hassanein and Afffy (2007), Baloi and Price (2003), Kartam and Kartam (2001)
Inflation of construction materials price	El-Sayegh (2008)
Fluctuation of the currency	El-Sayegh (2008)
Lack of solvency	Hassim et al. (2009) and Mills (2001)
Interest rates fluctuation	The Increasing Interest Rate and the Construction Industry BPE Solicitors (2020)
Lack of clarification in taxes liabilities	Hassanein and Afffy (2007)
Unavailability of foreign currency exchange	Zayed et al. (2008)
Unmanaged cash flow	Onengiyefori (2016)
Incomplete or inaccurate cost estimation	Turner (2014)
Lack of knowledge of RM	Goh and Abdul-Rahman (2013)
Absence of a structured risk management program	Choudhry and Iqbal (2013)
The time and cost needed for a risk management plan	Silva et al. (2013)
Lack of qualified expertise	Silva et al. (2013)
various identification of strategies for risk management	Tang et al. (2007)
No incentive for better risk management	Tang et al. (2007)

are loans, the Lebanese construction industry was required to see a critical lift. Lebanon has been suffering from a serious economic crisis, which has been increasing dramatically for the past two years, causing various challenges in the construction sector such as delay of payments from owners to contractors which will decidedly lead to the project delay. Therefore, this study is targeting the Lebanese construction industry because of the numerous challenges it is facing, with particular attention to the economic and financial risks encountered during the project life cycle in Lebanon.

2. Literature review

2.1. Risk management concept

Risk management is the culture, practices, and structures that are aimed at developing new benefits when managing negative consequences (AS/NZS 4360, 2004). In the form of construction project management, Zou et al. (2007) described risk management as a comprehensive method of identifying, assessing, and coping with risk to achieve the project goals and objectives. According to the British Standards BS31100 (2011), risk management is the mechanism by which resolutions are taken to consider a recognised or measured risk and to undertake steps to minimise the effects or the occurrence probability.

One of the most significant responsibilities of project managers is risk management; if it is not perceived as an essential duty, various issues and losses will follow. Dynamic risk management requires not only a precise methodology but also information, knowledge, and experience (Serpella et al., 2014). The fundamental motivation underlying risk management in construction projects is to give a safe workplace for the laborers and better accomplishment of goals. Sehat and Alavi (2010) clarified that risk management is a comprehensive process of risk identification and risk evaluation to include the details needed to decide on effective risk mitigation steps. Furthermore, it allows a system to better handle the normal risks in its day-to-day operations and to continue its processes in a more adequate and exhaustively environment, which will also help to produce reasonable results with more reduced costs. For the same reason, risk management is actively preparing for future incidents to occur. However, undermining risk management in construction has contributed to adverse outcomes and low quality of work. For example, the inefficiency of management and incorrect analysis of two significant project variables,

cost and time, which cannot be reliably measured, can lead to project delays and impose additional costs (Ali Rezvani Befrouei, 2015).

Project risk management interacts alongside other project components, and a successful risk management strategy greatly increases the probability of obtaining the project scope. Fig. 1 demonstrates that the influence of the other project components is combined with project risk management (Rezakhani, 2012). According to Abujnah and Eaton (2010), regarding coping with risk, the probability is an important term; however, its estimation has a long history. Therefore, definitions differ from the conventional deterministic principle that probability is the proportion of the event to the total variety of factors that are similarly probable to a singular or judgmental interpretation. The subsequent results are normally anticipated, while it may be more nebulously defined



Fig. 1. Integrating risk with other project management functions (Rezakhani, 2012).

in terms of estimating the cost of construction (Abuja and Eaton, 2010).

2.2. Risk classification

2.2.1. Internal risks

Normally in large construction projects, internal risks are connected to the team management's control. Referring to Aleshin (2001) internal risks originally come within the project, unlike the external risks which occur from the macro-level. They can be classified as follows: owner's responsibility, architects, suppliers, designers, contractors, and sub-contractors. They must be explicitly defined as performing for their results to minimise the risk to the owner's responsibility.

2.2.2. External risks

External risks are not particularly applicable to the process of construction, but they are of critical significance in terms of project efficiency. They can be categorised into political, socio-cultural, economic, natural, and other categories (El-sayegh, 2008). However, the political risks are classified as follows: risks of wars, modifications in law, corruption, bribery, and delays in approvals. Such risks are linked to the country's risk, which often involves situations where the home country is unable to pay the debt due to its economic problems. Some authors have become more specific in terms of political risk, specifically in multinational construction projects, with specific attention to variables such as labour expenses, supplies, and raw materials as well as overhead costs and foreign currency and exchange rates (Baloi and Price, 2003). In Lebanon, corruption has always occurred in all forms (nepotism, patronage, bribery, embezzlement, etc.), and its repercussions have escalated since the end of the 1990 civil war. However, political corruption has been described as the most massive corruption facing Lebanon, which is supported by the Lebanese people's views on corruption.

One of the most dangerous external risks that may affect the country and construction industry specifically is the risk of war. Lebanon has suffered from wars for the last two decades, where a war occurred in 1975–1990 that destroyed the economy and contaminated the environment and another war struck in 2006 (Srouf et al., 2010). The risk of war in Lebanon remains even today due to various economic and political reasons.

2.2.3. Pandemic risk

One of the major unexpected risks that will affect the productivity and lifecycle of the construction projects is the "pandemic risk". Pandemics are described as large-scale infectious disease outbreaks that can significantly increase death rates over a broad geographic region and trigger substantial economic, social, and political disturbance. Data show that the risk of pandemics has risen during the past century due to increased world travel, integration, urbanization, land-use shifts, and increased natural environment exploitation (Jones et al., 2008). On 9th January in the Wuhan province of China, the novel coronavirus was discovered. Companies around the globe have begun to contract their growth, irrespective of their size-dependent guidance from abroad. Travel and transport between countries have been limited and even constrained, which has affected the global economic growth between the countries (McKibbin and Fernando, 2020; Shibani et al., 2020; Shibani et al., 2021). Thus, COVID-19 has hurt the delivery of construction materials across the globe. According to the guidelines of the World Health Organisation (WHO), construction containment procedures are being enforced to ensure optimal protection for staff in construction, introduce effective prevention measures, and control the virus spread. Furthermore, construction would suffer significantly from the crisis as an immediate consequence of a

global demand shock and supply shock because of social distancing measures, with an estimated projection of 1.76 million workers endangered if the crisis lasts for 6 months (JCC.COVID-19; Shibani, 2020; Shibani, 2020).

2.2.4. Economic risks

Considering the economic and financial risk, El-Sayegh (2008) states that in countries such as UAE, inflation and abrupt price increases are the most significant economic risks. However, for countries such as Kuwait (Kartam and Kartam, 2001), and China (Fang et al., 2004) the same view is articulated. Therefore, in terms of inflation, (Nevitt and Fabozzi, 2000) argue that it is important to use the right forecasts to properly update future costs and that the lender with more experience is even better than the promoters of the project to carry out these accurate forecasts. Builders also see a large risk of inflation (Kartam and Kartam, 2001). When planning a large construction project, the main economic risk to be considered is the fluctuation of the currency, especially in the case of foreign projects. The development of privately funded infrastructure has recently focused on foreign capital in many countries, thereby running the risk of local currency devaluation. However, currency risk has been recognized by public corporations or governments in the past, but recently, with increasing demand for private funding, the risk of currency depreciation always rests with the project promoter and, eventually, with customers, because the investor is not prepared to assume it (El-Sayegh, 2008). Lebanon's central bank has fixed the Lebanese lira to USD at 1507 to 1 USD back in 1997. Since that, the stabilisation of the economy relied on a constant rate against the USD for the last 20 years. Furthermore, Lebanon imports 80 percent of the goods and materials because the government has not established self-sustaining internal enterprises on account of bureaucracy and corruption (Koffman, 2020). According to Koffman (2020), because of corruption and the economic crisis that hit Lebanon hardly at the beginning of 2020, the Lebanese lira started to lose its value as it almost reached 10,000 Lebanese lire per dollar. In addition, as the demand for USD continued to increase, banks started restricting USD withdrawals first at 300 USD and then to nothing at all. This led to financial challenges in the construction industry, where the owners delayed their payments to contractors and suppliers: this also led to delays in project completion.

2.3. Benefits of implementing risk management

The successful completion of construction projects is enhanced by a well-applied risk management plan and thereby making the project more profitable. As stated by Poh (2005) and Toader et al. (2010), the main benefits of the risk management process are as follows:

- Efficiency: the project managers will be aware of any risk, which may affect the project operation so that they do not take place. In the tendering process, the implementation of a risk management plan makes for rational project pricing.
- Considering the challenges that occur in the project lifecycle, implementing effective risk management increases the possibility of project completion and success with the minimum amount of loss.
- More systematic and detailed risk assessments can be produced in the presence of risk knowledge and information. The failures and mistakes made in previous construction projects can be prevented with the availability of risk expertise.
- Construction companies' impressive track record and demonstrated risk management systems will increase their chances of winning potential contracts from the same project owner, due to the good reputation the company has acquired.

- The communication between project parties may be enhanced by an effective risk management process.

Finally, from previous several construction ventures in developed countries like Lebanon are suffering from delays in terms of project execution at defined times, overruns of costs, and quality issues, sometimes these losses are responsible for converting profitable enterprises into losing ones. Therefore, an accurate and productive construction risk management function would improve the successful execution of construction projects and render the project more viable.

3. Research methodology

Depending on the research onion, the philosophy, approach to theory development, research methods, research strategy, time horizon, techniques, and procedures for this study are shown in Fig. 2 below. Research philosophy defines the theory of a study in a specific field, and it describes the principles underlying research methods (Maylor and Blackmon, 2005). Moreover, according to Da Veiga (2016), the type and form of data gathered in the research study are identified in the research philosophy. The philosophy adopted in this study is the positivist philosophy, as the method used to collect the primary data needed in this study is the “quantitative method,” by sending a questionnaire to specialists and experts in the Lebanese construction industry to collect the appropriate data for this research and analyse the outcomes in the context of statistical data. Therefore, according to Chetty (2020), the quantitative method is the one that needs to be implemented and adopted in the activism philosophy as it is based on statistical tools. In conclusion, activism is most suitable for achieving the aim and covering the objectives of the research. In the literature review, all the data are secondary taken from recent studies in terms of conventions between authors about the most significant risks affecting the construction industry and the importance of risk management.

These data have been collected from articles, journals, and books concerning the financial risks in the construction industry and risk management. Moreover, primary data are essential in this study to come up with more exact and accurate data but not limited to the financial risks affecting the Lebanese construction project and identifying the benefits and potential barriers of implementing an effective risk management plan in Lebanon an acceptable percentage of responses is above 60%.

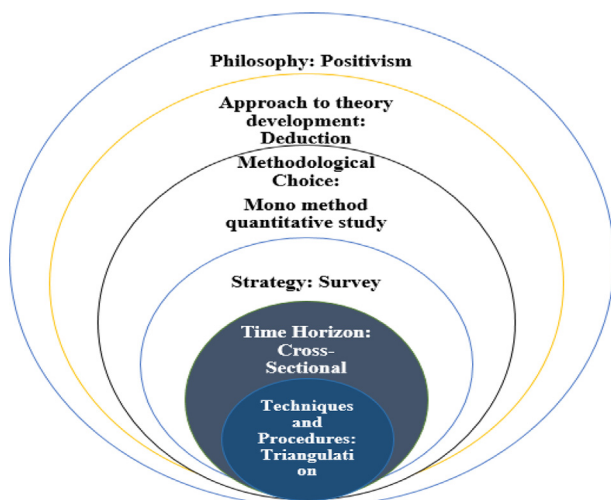


Fig. 2. Research Onion for current students.

At the outset of the study, the questionnaire is used as a tool for data collection. It attempts to identify and explain the major risks affecting the construction projects in Lebanon. Therefore, the main aim of this questionnaire is to answer the research questions. The first stage of the questionnaire is based on the respondent's personal information; this section includes the participant's details such as ethnicity, age, current job, and personal experiences to maintain a diversity of viewpoints and experiences in the Lebanese construction industry. The second stage contains questions and responses regarding risk factors taken from literature reviews. Participants were asked to evaluate these factors on a Likert 5-point scale. This stage shows the level of awareness of the major risks affecting construction projects in Lebanon, which will help the companies and construction organizations to take the most important step in the risk management plan, namely 'risk identification', and identify the most significant risks to set appropriate risk management specific to the Lebanese construction sector. The third stage is based on ranking the benefits of implementing risk management in the Lebanese construction industry. It shows a variety of benefits taken from the literature review and based on past studies made in various developed countries and large construction companies that showed significant progress after implementing effective risk management plans in their projects. The fourth stage of the questionnaire is the last one. In this stage, the participants were asked to rank the potential barriers to implement risk management, which will illustrate the awareness and understanding of the barriers to risk management implementation in the Lebanese construction industry. To ensure whether the data collected are accurate, these data will be analysed using SPSS software to assess the reliability of answers, especially for the questions of the Likert scale. Therefore, Cronbach's alpha and correlation values will be calculated. However, this will reveal that the factors listed in the questionnaire survey can be categorized as risk factors and benefits and barriers in the Lebanese construction industry.

4. Data analysis and result

Statistical data obtained from the questionnaire and check whether an RM implementation in Lebanon is necessary by the responses of highly experienced academics and experts in the Lebanese construction industry to the questionnaire and identifying their understanding of the factors that influence building projects. In addition, after analysing the results of the questionnaire, the objectives of the study will be addressed and discussed. Therefore, new results will be discussed about the value of RM's ongoing implementation in Lebanese companies, and the participants' perceptions of its barriers will also be discussed. Information about respondents.

4.1. Workers

As illustrated in Fig. 3, the result of the questionnaire in this part shows that 70% of respondents work in the private sector and 30% work in the public sector. The respondent's work categories were divided into five sections. The results show that most respondents are engineers (45%); 19% are consultants; 17% are academics; 17% are contractors, and 2% work in operations, as shown in Fig. 4. As shown in Fig. 5, the questionnaire shows that 56% of respondents have less than 5 years of experience in the industry, while 20% have between 5 and 10 years. Fourteen percent have an experience between 11 and 20, whereas 10% have more than 20 years of experience in the Lebanese construction sector (see Fig. 6).

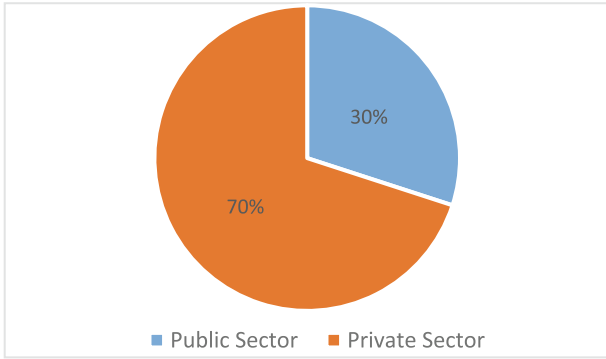


Fig. 3. Participants' work nature.

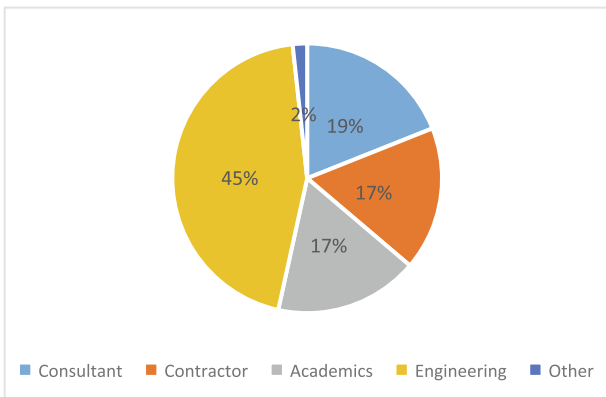


Fig. 4. Distribution of the experts' professions in the construction industry.

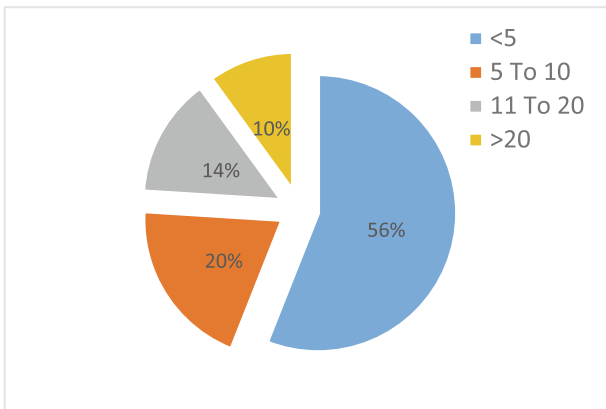


Fig. 5. Participants' years of experience.

4.2. Risk factors

The first risk factor mentioned in the questionnaire is the risk of war, which is an external risk. However, 22 participants were very likely to agree on this risk factor, while 12 of them answered that they were likely to agree. Eight experts responded as moderately agree and eight others answered somehow likely agree, whereas none of the participants responded as unlikely to agree on the risk of war. Seventeen of the participants answered very likely agree with the pandemic risk, while sixteen answered likely agree that the pandemic risk affects the productivity of construction projects. Six respondents answered moderately agree on this factor; how-

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.721	.725	26

Fig. 6. Cronbach's Alpha for the current research.

ever, 10 participants somehow likely agree, while only one of the respondents answered unlikely to agree on the pandemic risk factor. Twenty of the participants responded very likely agree that the corruption in the Lebanese construction industry affects the project lifecycle, and 19 agreed with them and answered likely agree; six answered moderately agree, and only three responded as unlikely to agree. However, none of the participants answered somehow likely agree with this risk factor.

Most of the participants responded very likely agree on the risk of political corruption (25 respondents), and 15 respondents answered as likely agree. However, five respondents moderately agreed, as well as five others answered as somehow likely to agree, but none of the participants answered as unlikely to agree. Of the 50 participants, 19 likely agreed that the delayed payment to contractors is one of the significant risks in the construction projects in Lebanon, while 15 answered moderately agree and 12 answered very likely to agree. Finally, three experts answered somehow likely agree and only one answered unlikely to agree on this risk factor. Half of the expert participants moderately agreed that the design change is one of the significant risks in the Lebanese construction projects and eleven of them answered somehow likely agree. In addition, eight answered likely agree, whereas only three respondents very likely agreed. Finally, two respondents had a contrasting opinion as they answered as unlikely to agree on the design change risk factor. Twenty-one participants likely agreed that the inflation of the construction materials price is one of the major risks that impact the construction projects; moreover, 14 others answered as very likely agree. Seven respondents chose moderately agree, seven others answered as somehow likely agree. However, only one had a negative response on this factor and answered unlikely as shown in Table 2.

The results in the table show that more than half of the participants very likely agreed that the fluctuation of the currency is classified as one of the most significant risks affecting the construction projects in Lebanon, and 13 answered as likely agree. Six participants chose moderately agree, whereas two answered as unlikely to agree and one answered as somehow likely agree. Twenty-three participants responded as moderately agree on the lack of solvency risk, and 13 answered somehow likely agree. Moreover, seven respondents chose likely agree and four very likely agreed, while only two disagreed with this risk factor and answered as unlikely to agree.

For the interest rate fluctuation risk, 21 of the participants moderately agreed on this factor, whereas sixteen of them likely agreed that the interest rate fluctuation affects the construction projects in Lebanon, while eight specialists answered as somehow likely agree. Only three experts in the Lebanese construction sector very likely agreed on this risk factor; two disagreed with it and answered unlikely to agree. Seventeen participants moderately agreed on the risk of lack of clarification in tax liabilities; in addition, 10 respondents answered somehow likely. Nine of the participants answered likely to agree, and five of them answered very likely agree. However, 10 participants responded as somehow likely agree, whereas nine provided negative responses and

Table 2
Findings related to risk factors.

Risk Factors	Unlikely	Somehow Likely	Moderate	Likely	Very Likely
Risk of war	0	8	8	12	22
Pandemic risk	1	10	6	16	17
Corruption in the LCS	3	0	6	19	22
Political Corruption	0	5	5	15	25
Delayed Payments to contractors	1	3	15	19	12
Design change	2	11	25	8	3
Inflation of construction materials price	1	7	7	21	14
Fluctuation of the currency	2	1	6	13	28
Lack of solvency	2	13	23	7	4
Interest rates fluctuation	2	8	21	16	3
Lack of clarification in taxes liabilities	9	10	17	9	5
Unavailability of foreign currency exchange	1	13	5	19	12
Unmanaged cash flow	2	12	26	7	3
Incomplete or inaccurate cost estimation	3	16	20	8	3

answered as unlikely agree. Nineteen participants likely agreed that the unavailability of foreign currency exchange risk affects the productivity and efficiency of the Lebanese construction projects, and 12 answered as very likely to agree. Thirteen people responded that they were somehow likely to agree, five moderately agreed, and only one had a negative response and answered unlikely to agree.

Table 2 illustrated that 26 participants moderately agreed that the unmanaged cash flow affects the construction projects in Lebanon, and 12 answered as somehow likely to agree. Seven respondents answered as likely agree with this risk factor, while three answered as very likely agree. However, only two answered as unlikely to agree. On the other hand, 20 respondents moderately agreed regarding the incomplete or inaccurate cost estimation risk factor, whereas sixteen participants somehow likely agreed on this factor. Eight experts likely agreed on this factor. However, only three respondents answered as very likely to agree and three others were unlikely to agree on the inaccurate cost estimation risk factor.

4.3. Benefits of implementing risk management

Twenty-one participants likely agree that the implementation of Risk Management improves the efficiency in the Lebanese construction projects; in addition, 16 more participants very likely agreed on this benefit. However, nine participants moderately agreed with it, two somehow likely agreed, and only one disagreed on these benefits of implementing RM and answered unlikely agree. As shown in the table 24 participants likely agreed that the implementation of Risk Management would provide more accurate project pricing within the tendering phase. Moreover, 17 experts responded as very likely to agree with this benefit. Only five respondents moderately agreed and three of them somehow likely agreed, whereas none of the participants were against this benefit as none voted unlikely to agree. The data in Table 3 illustrated that 27 participants likely agreed that Risk Management will increase the possibility of the project's success and 12 very likely

Table 3
Findings on Risk Management Benefits.

Risk Management Benefits	Unlikely	Somehow Likely	Moderate	Likely	Very Likely
Improve efficiency	1	2	9	21	16
More accurate project pricing in the tendering	0	3	5	24	17
Increase the Possibility of project success	0	1	10	27	12
Minimize losses	0	3	8	13	26
Better reputation for the company	2	5	12	22	8
Improve communication between project parties	2	5	11	14	17

agreed on this RM implementation benefit. However, 10 specialists answered as moderately agree, while only one answered as somehow likely to agree. Finally, there was no negative response as none answered unlikely to agree on this RM implementation benefit. The above table illustrates that more than half of the participants (26) very likely agreed that RM implementation will lead to a minimisation in losses within the Lebanese construction projects. Thirteen participants also agreed with them as they answered likely to agree. However, eight specialists moderately agreed on these benefits, of which three answered as somehow likely agree, but none answered as unlikely to agree. Table 3 shows that 22 of the participants agreed that implementation of an appropriate RM plan will provide the company with a better reputation; however, twelve others moderately agreed with this. Furthermore, eight of the experts very likely agreed on this RM implementation benefit. Five participants somehow likely agreed, whereas two answered against this benefit.

4.4. Barriers to implementing risk management

Table 4 shows that 24 participants likely agreed that the lack of knowledge is a barrier that prevents RM implementation in Lebanese construction companies, and eleven respondents very likely agreed. Moreover, seven respondents answered moderately agree on this barrier, while three somehow likely agree. Finally, five participants unlikely agreed that a lack of knowledge is considered a potential barrier to RM implementation. Twenty participants likely agreed that the absence of a structured risk management program is a barrier that prevents the companies from implementing RM in their projects; in addition, eighteen respondents very likely agreed on this. However, seven respondents moderately agreed on this barrier, and three of them somehow likely agreed. Finally, two of the participants had a negative response as they answered unlikely to agree. Almost half of the participants (23 respondents) very likely agreed that the time and cost needed for a RM plan is considered a significant barrier to RM implementation in Lebanon; sixteen respondents very likely agreed on this barrier. However, the

Table 4
Findings on Risk Management Barriers.

Risk Management implementation barriers	Unlikely	Somehow Likely	Moderate	Likely	Very Likely
Lack of knowledge of RM	5	3	7	24	11
Absence of a structured RM program	2	3	7	20	18
The time and cost needed for an RM plan	2	3	6	16	23
Lack of qualified expertise	2	9	4	21	13
various identification of strategies for RM	0	8	18	15	7
No incentive for better RM	1	4	11	10	21

table shows that six participants moderately agreed on this barrier. Furthermore, three answered somehow likely to agree and two participants responded that they were unlikely to agree. Eighteen respondents moderately agreed that various identifications of strategies for risk management are a barrier to RM implementation, whereas 15 likely agreed on the effect of this barrier. Furthermore, eight respondents answered somehow likely agree, while seven very likely agreed on this barrier. The above table shows that the majority of participants very likely agreed that “no incentive for better RM” is considered a significant barrier to RM implementation in the Lebanese construction companies, whereas eleven responded answered moderately agree with this barrier. Ten participants likely agreed on this barrier, while four somehow likely agreed and only one unlikely agreed that this is considered as a barrier that prevents RM implementation in the Lebanese construction industry.

4.5. Reliability analysis

As mentioned earlier, the questionnaire's main questions are based on a Likert scale. Therefore, these types of questions are best analysed using SPSS software. The data obtained are analysed and validated using a reliability test to calculate Cronbach's alpha. Lee Cronbach developed alpha for measuring the internal consistency of a measure or scale in 1951; it was described as a number from 0 to 1. Internal consistency defines the degree to which all the elements of the test evaluate the same definition or form and that the interrelation between the elements is related in the test (Tavakol and Dennick, 2011). The reliability test is conducted to ensure that the method used as a data collection method is accurate, the alpha coefficient range from 0 to 1, therefore, to attain reliable instruments, the alpha should be greater than 0.6 (Mubarak, 2017). Since the risk factors analysed in this research were integrated into the five modules, the internal consistency between the assessments of these factors by the respondents was crucially significant. Therefore, it was agreed to use the Cronbach's alpha instrument to accomplish this purpose. In this research, the result of the reliability test was 0.721 which is greater than 0.5; this indicates that the Likert scale measurement is reliable at the 5% significance level (Norusis, 2005).

4.5.1. Ranking of risk factors affecting the construction projects in Lebanon

The questionnaire survey of this research contains fourteen Likert scale questions at the first stage about the major risks inherent to the construction industry with consideration of the financial risks. The ranking of risk factors was done using the concept of mean values for each risk. However, the statistical ranking of the 14 risk factors enables to evaluate the results of the respondents based on the mean values provided for each risk factor. Therefore, this segment demonstrates the risk factors classification and ranking. It was found that the risks that most affect and negatively impact the efficiency and productivity of the construction projects in Lebanon are considered by the respondent as follows; political corruption (4.38), fluctuation of the currency (4.26), corruption in

Table 5
Classification of the risk factors based on the questionnaire results.

Risk Factors	Mean
Political corruption	4.38
Fluctuation of the currency	4.26
Corruption in the Lebanese construction sector	4.14
Risk of war	3.96
Inflation of construction materials price	3.82
Delayed Payments to contractors	3.72
Pandemic risk	3.7
Unavailability of foreign currency exchange	3.48
Interest rates fluctuation	3.24
Design change	3.02
Lack of solvency	2.94
Unmanaged cash flow	2.92
Incomplete or Inaccurate Cost estimation	2.86
Lack of clarification in taxes liabilities	2.76

the Lebanese construction industry (4.14), risk of war (3.94), and inflation of construction material cost (3.82). Furthermore, delayed payments to contractors (3.72) and pandemic risk (3.7) are also considered one of the most significant risks. The mean values of all the risk factors are represented in Table 5 above.

4.5.2. Ranking of the benefits of implementing risk management in the Lebanese construction

The mean value comparison is used to compare the benefits of implementing RM and to classify and rank these benefits. In the section on RM implementation, ‘minimize losses’ showed the highest mean value (4.24) as the ‘more accurate pricing in the tendering’ constitutes an important benefit as well (4.14). Interestingly, the ‘increase in the possibility of project successes’ had also a significant mean value (4.00). However, ‘increase efficiency’, ‘improve communication between the project parties’, and ‘better reputation for the company’ had the lowest mean value of (3.98), (3.76), and (3.56) respectively. Table 6 represents the benefits of implementing RM with the mean value of each one of them.

4.5.3. Ranking of barriers to implement risk management in the Lebanese construction industry

The last section of the questionnaire is to rate the barriers to implementing RM in the Lebanese construction companies by using Likert scale questions. Respondents' answers were used in this research to rank and classify the most significant barriers to implement RM. Therefore, concerning the experts' responses, the most significant barriers that had the highest mean value are ‘The time and cost needed for an RM plan’ (4.1), ‘Absence of a

Table 6
Classification of the benefits of implementing RM based on the questionnaire results.

RM Benefits	Mean
Minimize losses	4.24
More accurate project pricing in the tendering	4.14
Increase the Possibility of project success	4
Improve efficiency	3.98
Improve communication between project parties	3.76
Better reputation for the company	3.56

Table 7
Classification of the barriers to implementing RM based on the questionnaire results.

Barriers	Mean
The time and cost needed for a Risk Management plan	4.1
Absence of a structured Risk Management program	3.98
No incentive for better Risk Management	3.94
Lack of qualified expertise	3.72
Lack of knowledge of RM	3.66
Various identification of strategies for Risk Management	3.46

structured Risk Management program' (3.98), 'No incentive for better risk management (3.94), and 'Lack qualified expertise' (3.72). In addition, 'Lack of knowledge of RM' and 'various identifications of strategies for RM had the lowest mean value based on respondents' answers with a value of (3.66) and (3.46), respectively. In this regard, all the mean values of barriers are represented in [Table 7](#).

5. Conclusion and key findings

This research revealed the existing condition of the Lebanese construction industry and the benefits and barriers of implementing RM. This research aimed to identify major risks inherent in the Lebanese construction projects, where there was particular attention to the financial and economic risks due to the current situation of the country. To achieve this aim, an investigation was required to clarify the principles and core problems of RM. Therefore, the quantitative process methodology applied through a survey explained the attitude and understanding of construction industry experts in Lebanon regarding the significant risks and the concept of RM in construction, who underlined the value of implementing RM.

To fulfil the research objectives, the questionnaire was carefully designed and structured to achieve the participant's perceptions of the risk factors in construction projects as well as the benefits and barriers of RM implementation. Therefore, the participants have approved most of the advantages of RM stated in the Likert scale questions, as well as most of the barriers. The results were concluded and analysed using SPSS.

The questionnaire contained 14 risk factors (internal, external, and financial). The main reasons for RM factors in the Lebanese construction industry are as follows: risk of war, pandemic risk, corruption in the Lebanese construction sector, political corruption, delayed payments to contractors, design change, inflation of construction materials price, fluctuation of the currency, lack of solvency, interest rate fluctuation, lack of clarification in tax liabilities, unavailability of foreign currency exchange, unmanaged cash flow and incomplete or inaccurate cost estimation. On the other hand, the RM benefits in Lebanon are improving efficiency, more accurate project pricing in the tendering that increases the possibility of project success, minimise losses, better reputation for the company, and improved communication between project parties. RM implementation barriers are lack of knowledge of RM, absence of a structured RM program, time and cost needed for an RM plan, lack of qualified expertise, various identifications of strategies for RM, and finally, no incentive for better RM.

From the questionnaire survey, 70% of respondents work in the private sector, and 30% work in the public sector. However, most respondents are engineers (45%); 19% are consultants; 17% are academics; 17% are contractors and 2% work in operations. The questionnaire shows that 56% of respondents have less than 5 years of experience in the industry, while 20% have between 5 and 10 years. 14% have an experience between 11 and 20 whereas 10% have more than 20 years of experience in the Lebanese construction industry. The first risk factor mentioned in the questionnaire is

the risk of war, which is an external risk. From the results, 34 of the participants strongly agree and agree with this risk factor about (100%) of the sample; on the other hand, 80% answered very likely and likely agree that the pandemic risk affects the productivity of construction projects during the pandemic, while 20% responded as unlikely to agree. The results show that 39 of the participants responded as very agree and agree that the corruption in the Lebanese construction industry affects the project's lifecycle, whereas six moderately agree and only three unlikely agreed. All participants agree that the risk of political corruption (40 respondents; about 100%) affects the Lebanese construction industry. On the other hand, 39 participants agreed that the delayed payment to contractors is one of the RM in the Lebanese construction industry. Half of the participants moderately agreed that the design change is one of RM in the Lebanese construction industry. The inflation in the price of construction materials is one of the primary threats affecting the Lebanese construction industry, and 21 participants most likely agreed with this. The currency fluctuation is most likely considered one of the most significant hazards impacting the LCI by half of the participants. For the interest rate fluctuation risk, 37 of the participants moderately agreed on this factor, whereas 16 likely agreed. Twenty-seven respondents agreed on the risk of the lack of clarification in tax liabilities. Moreover, 10 participants responded as somehow likely agree, whereas nine answered as unlikely to agree. In the case of unavailability of foreign currency exchange risk affecting the productivity and efficiency of the Lebanese construction industry, 31 participants (84%) very likely agreed and likely agree, whereas five moderately agreed and only one responded as unlikely to agree. On the other hand, 26 participants moderately agreed that the unmanaged cash flow affects the Lebanese construction industry. Only three very likely agreed, but two participants were unlikely to agree. Thirty-six respondents moderately agreed on the incomplete or inaccurate cost estimation risk factor, whereas only three respondents very likely agreed; three others unlikely agreed on the inaccurate cost estimation risk factor.

In the case of benefits of implementing RM, 37 of the participants likely agreed and agreed that the implementation of RM improves the efficiency in the Lebanese construction industry and only one disagreed. About 41 (91%) of the participants likely agreed that the implementation of RM would provide more accurate project pricing within the tendering phase. Furthermore, 30 participants agreed that the implementation of appropriate RM, while two were against this benefit. In the case of barriers to implement RM, about half of the participants likely agreed that the lack of knowledge is a barrier that prevents RM implementation in Lebanese construction industry, and five participants responded as unlikely to agree. Thirty-eight participants likely agreed that the absence of a structured RM program is a barrier preventing the companies from implementing RM in their projects. However, two of the participants responded as unlikely to agree. Almost half of the participants (23 respondents) very likely agreed that the time and cost needed for the RM plan is considered a significant barrier to RM implementation in Lebanon; 16 participants very likely agreed, three likely agreed, and two unlikely agreed with this view.

Eighteen respondents moderately agreed that various identifications of strategies for RM are a barrier to RM implementations, whereas 15 likely agreed on the effect of this barrier, eight respondents chose as they somehow likely agree, and seven very likely agreed on this barrier. The majority of the participants very likely agreed that "no incentive for better RM" is considered a barrier to RM implementation in the Lebanese construction companies. However, 14 participants likely agreed and only one unlikely agreed that this is considered a barrier that prevents RM implementation in the LCI.

The results show that 80% of the participants agreed that the political corruption is ranked as the highest risk affecting the construction projects in Lebanon, which is an external risk factor; this makes it compatible with a study conducted by El-Sayegh (2008) who reported that political corruption is classified as one of the external risks that affect the construction industry. Political corruption was described as Lebanon's most serious corruption problem, and it simultaneously hurt the construction industry. Therefore, the respondents' answers made this risk viable.

In addition, most of the risks were validated and proved to be reliable in the Lebanese construction projects based on the experts' responses, which makes these risks viable and compatible with the previous studies in the literature review. Furthermore, this ensured that the study answers the research question and achieves the research aim, which is identifying the most significant risks that affect the construction projects in Lebanon. The participants agreed with most of the benefits stated in the Likert scale questions, which indicates that the experts in the Lebanese construction industry are aware of the importance of RM in the project life cycle. The results show that the implementation of an effective RM plan in the construction projects in Lebanon will minimise the losses in the process of construction, especially in a country like Lebanon that has a high risk of currency fluctuation as well as the risk of inflation of construction material prices. Therefore, the participants ensure that implementing the appropriate RM plan that is compatible with the current economic situation of the country is advantageous in avoiding most of the risks that may occur in project execution. In addition, all the benefits mentioned in the questionnaire had a mean value of 3.5 based on the participants' responses. This demonstrates that the results agree with the research conducted by Poh (2005) and Toader et al. (2010) about the benefits of RM implementation, which make these benefits viable and applicable in the Lebanese construction industry. Moreover, the experts approved that RM is important and play a significant role in the project's success. However, this implementation has various barriers in Lebanon, where these barriers were approved by the participants. The time needed to implement RM was classified as the first barrier preventing RM implementation. In Lebanon, time is a major factor in the construction project success, owing to various risks that threaten the country (economic, political, wars), in addition to the corruption that is one of the major factors to project delay in Lebanon as stated earlier by Mezher and Tawil (1998).

The main outcome from the survey demonstrates that proper implementation of a risk management strategy in the Lebanese construction industry will reduce losses in the project and increase the possibility of its success. However, construction risk management was not sufficiently implemented in the Lebanese construction sector. The two major reasons for this are the time and cost needed for an RM plan and the absence of an RM program in the companies.

To ensure that the data collected are admissible and viable in the Lebanese construction sector, the data were documented through a questionnaire survey and distributed to experts in this field. Therefore, the outcome of the questionnaire reveals that the construction sector in Lebanon is subject to several risks that affect its efficiency and productivity, and the risk of war is classified as the predominant risk factor.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

- Shibani, A., Bhavsar, A., Hassan, D., Saidani, M., Agha, A., 2021a. Investigating the benefits of BIM for mid-rise timber buildings in Canada: A qualitative study. *IJRDO-J. Mech. Civil Eng.* 7 (1), 1–32.
- Shibani, A., Ghostin, M., Hassan, D., Saidani, M., Agha, A., 2021b. Exploring the impact of implementing building information modelling to support sustainable development in the Lebanese construction industry: A qualitative approach. *IJRDO-J. Mech. Civil Eng.* 7 (1), 33–62.
- Shibani, A., Mahadel, O., Hassan, D., Agha, A., Saidani, M., 2021c. Causes of time overruns in the construction industry in EGYPT. *Int. Res. J. Modern. Eng. Technol. Sci. (IRJMETS)* 3 (1), 510–531.
- Shibani, A., Agha, A., Hassan, D., Al-Hadeethi, Y., Choudhury, M., 2021d. Effectiveness of the modern methods of construction in terms of cost and time: A case study of the United Kingdom. *J. Civil Eng. Res.* 11 (1), 19–28. <https://doi.org/10.5923/j.jce.20211101.03>.
- Abrahamson, M.V., 1984. Risk management. *International Construction Law Rev.* 1 (3), 241–264.
- Abuja, M., Eaton, D., 2010. *Towards a Risk Management Framework for Libyan House-Building Projects* [online]. University of Salford.
- Aleshin, A., 2001. Risk management of international projects in Russia. *Int. J. Project Manage.* 19 (4), 207–222.
- Ali Rezvani Befrouei, M., 2015. Identification and management of risks in construction projects. *Am. J. Civil Eng.* 3 (5), 170.
- Baloi, D., Price, A.D.F., 2003. Modelling global risk factors affecting construction cost performance. *Int. J. Project Manage.* 21 (4), 261–269.
- British Standards Institution, 2011. *Risk Management: Code of Practice and Guidance for the Implementation of BS ISO 31000: BS 31100: 2011*. BSI, London.
- Da Veiga, A., 2016. A cybersecurity culture research philosophy and approach to develop a valid and reliable measuring instrument. *SAI Computing Conference (SAI)*.
- El-Sayegh, S.M., 2008. Risk assessment and allocation in the UAE construction industry. *Int. J. Project Manage.* [online] 26 (4), 431–438.
- Fernando, W.J.M. and R., 2020. The Global Macroeconomic Impacts of COVID-19: Seven Scenarios [online] Available from: <https://www.brookings.edu/research/the-global-macroeconomic-impacts-of-covid-19-seven-scenarios/> [27 Dec 2020].
- Goh, C.S., Abdul-Rahman, H., 2013. The identification and management of major risks in the Malaysian construction industry. *J. Constr. Dev. Count.* 18 (1), 19–32.
- JCC, 2020. COVID-19 : Ethiopia Potential impact on jobs & incomes & short-term policy options.
- Jones, K.E., Patel, N.G., Levy, M.A., Storeygard, A., Balk, D., Gittleman, J.L., Daszak, P., 2008. Global trends in emerging infectious diseases. *Nature* [online] 451 (7181), 990–993.
- Kartam, N.A., Kartam, S.A., 2001. Risk and its management in the Kuwaiti construction industry: A contractors' perspective. *Int. J. Project Manage.* 19 (6), 325–335.
- Koffman, T., 2020. Lebanon's Currency Crisis Paves The Way To A New Future [online] available from <https://www.forbes.com/sites/tatianakoffman/2020/07/09/lebanons-currency-crisis-paves-the-way-to-a-new-future/?sh=10a35b076a17>. [27 November 2020].
- Tavakol, M., Dennick, R., 2011. Making sense of Cronbach's alpha. *Int. J. Med. Educ.* 2, 53–55. <https://doi.org/10.5116/ijme.4dfb.8dfd>.
- Maylor, H., Blackmon, K. (Eds.), 2005. *Researching Business and Management*. Macmillan Education UK, London.
- Mubarak, Husin, S., Oktaviati, M., 2017. External Risk Factors Affecting Construction Costs.
- Rezakhani, P., 2012. *Classifying Key Risk Factors in Construction Projects*. Kyungpook National University, Korea.
- Sehat, S., Alavi, S.S., 2010. The necessity of application of risk management to third party insurance, and the impact of new third party insurance laws on the related risks. *J. Insurance World News* 144 & 145.
- Serpella, A.F., Ferrada, X., Howard, R., Rubio, L., 2014. Risk management in construction projects: A knowledge-based approach. *Proc. Soc. Behav. Sci.* 119, 653–662.
- Shibani, A., 2020. Adopting building information modelling in small and medium enterprises of Iraq's construction industry, International Conference on Industrial Engineering and Operations Management. March ed. IEOM Society, p. 457–470 14 p.
- Shibani, A., Hassan, D., Shakir, N., 2020a. The effects of pandemic on construction industry in the UK. *Mediterranean J. Soc. Sci.* 11 (6), 48.
- Shibani, A., Yang, W., Hassan, D., 2020b. Evaluate the UK construction project impact and response strategies during the epidemic through Malaysia and China. *J. Adv. Res. Civil Environ. Eng.* 7 (3&4), 1–10.

Further reading

- Achieve, K.P.S.M., 2020. Ideal client would be passionate about what they are trying to, 2020. The Increasing Interest Rate and the Construction Industry [online] available from https://www.bpe.co.uk/discover-bpe/why_bpe/insight/s/2017/11/the-increasing-interest-rate-and-the-construction-industry [27 Nov 2020].

- Flanagan, R., Norman, G., 2000. Risk Management and Construction. Blackwell Publishing Ltd, Oxford.
- Li, B., Akintoye, A., Edwards, P.J., Hardcastle, C., 2005. Critical Success Factors for PPP/PFI Projects in the UK Construction Industry. *Constr. Manage. Econ.* 23 (5), 459–471.
- Maylor, H., 2003. Project Management, London. Financial Times/Prentice Hall, New York.
- Odhiambo, O., 2016. Risk Management System to Guide Building Construction Projects in Developing Countries: A Case Study of Nigeria. Ph.D. Faculty of Science and Engineering, University of Wolverhampton.
- Tah, J.H.M., Carr, V., 2001. Towards a framework for project risk knowledge management in the construction supply chain. *Adv. Eng. Softw.* 32 (10–11), 835–846.
- Tchankova, L., 2002. Risk identification – basic stage in risk management. *Environ. Manage. Health* 13 (3), 290–297.