



Developing a Model to Evaluate the Level of Risk Management Practices in Construction Companies Based on ISO 31000:2018

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Abstract:

Construction companies face many risks that hinder them from completing projects at the planned cost, time, and required quality. The companies work to confront these risks through various methods and risk management plans. Therefore, the research aims to develop a model to evaluate the level of risk management practices in construction projects and companies in accordance with the international standard ISO 31000:2018. This model will examine all requirements of the risk management plan, and it will be applied to a case study of "The General Company for Roads and Bridges" in Syria. The data were obtained through a questionnaire distributed to engineers within the company, and analysed using SPSS. The results have shown that the proposed model is characterized by efficiency and ease of use, and that the average of the company's commitment to the Specification items is 2.71, which is an average value. In addition, the item with the lowest value for the company's commitment to it is "Continually Improving" in the risk management Framework, and the item with the highest value is "Defining the Scope" of risk management activities.

Keywords:

Construction Companies; ISO 31000:2018; Risk Management; Risk Management Maturity Model; Syria.

Highlights:

- Providing a model to evaluate the level of risk management maturity in construction companies based on the international standard ISO 31000:2018.
- Applying the proposed model to a case study and comparing the results with the level of risk management in many previous studies.
- The average commitment of "The General Company for Roads and Bridges" to the items of the specification is 2.71, which is an average value.

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Article History:

Received:	02 May 2024
Received in revised form:	14 Dec. 2024
Accepted:	29 Aug. 2025
Final Proofreading:	11 May 2026
Available online:	15 Sep. 2026

Citation:

Salim H, Jrad F, Maya R. **Developing a Model to Evaluate the Level of Risk Management Practices in Construction Companies Based on ISO 31000:2018.** *Tikrit Journal of Engineering Sciences* 2026; 33(2): 2169.

<https://doi.org/10.25130/tjes.33.2.6>

1. INTRODUCTION

Road and bridge projects are considered vital infrastructure because of their major role in connecting various regions, as reflected in economic terms. That is in addition to the role of this type of project in demonstrating the extent of the country's capacity and the development of its construction industry. The process of developing bridges has also accelerated in recent years due to significant economic growth and urbanization [1-5]. Construction projects include the stages of planning, design, construction, operating and decommissioning, and each entails its own risks [6, 7]. The construction industry in Syria faces risks that may constitute an obstacle to the success of construction projects [8]. Risks are unavoidable in construction projects and may arise at different stages of the project life cycle [9]. Most previous studies confirm that highway projects are exposed to higher risks than other construction projects, because they are spread over a broader geographical area and are also subject to underground conditions [10]. Also, construction projects are exposed to many risks due to the involvement of multiple parties, including owners, designers, contractors, subcontractors, and suppliers [11]. Focusing on risk management is becoming a goal pursued by all organizations at the moment [12]. As the uncertainty in the surrounding environment escalates, it becomes necessary for companies to realize the importance of effectively implementing a risk management system, which makes it difficult to plan and execute [13]. Effective risk management is a fundamental process in construction projects, playing a vital role in ensuring successful project outcomes [14, 15]. Risk management is a strategic challenge for organizations facing increasingly complex and diverse threats [16]. Risk management practices are of great importance to construction companies, as they help reduce potential problems arising from uncertainties in construction projects [17, 18]. Effectively managing risks in construction projects demonstrates expertise, improves customer satisfaction, and increases the likelihood of working with the client in the future [19]. For companies implementing road and bridge projects to finish them within the specified period without exceeding the set cost and meeting the required quality, they must rely on standard maturity models to manage risks and measure their implemented practices. In general, it is noticed that risk management maturity models can effectively help organizations understand the level of their current risk management practices as well as identify the strengths and weaknesses of their risk management performance [20]. Many studies have discussed the use of the international standard ISO 31000:2018 for risk

management. In 2009, the risk management standard was issued for the first time [21] and then updated in 2018 [22]. The international standard ISO 31000:2018 includes risk management principles, a framework, and a process [22]. The international standard ISO 31000:2018 can be applied in all companies, regardless of their size, type, activity, or location, and covers all types of risks [23]. Due to the lack of a model for evaluating risk management practices based on the international standard ISO 31000:2018, the research addresses this problem by developing a model based on this Specification that covers all stages of risk management.

2. LITERATURE REVIEW

Zou et al. (2010) developed a model which evaluates risk management maturity for construction organizations. This model consists of five features: risk management, followed by risk culture, the ability to identify and analyze risks, and a standard process for risk management. These features were measured across four levels, and the results showed that the overall level of risk management maturity in the Australian construction industry was relatively low [24]. Hwang et al. (2014), on the other hand, investigated the level of risk management implementation in small projects in Singapore and identified the factors that hinder its implementation, as well as the impact of implementing risk management on project performance. The authors concluded that the level of risk management was relatively low due to several factors, most notably the lack of time and budget. The profit margin was low and the operation was uneconomical. This emphasised the risk management benefits of saving time and reducing costs, as well as improving quality [25]. Mu et al. (2014) identified six indicators to evaluate a contractor's risk management ability: risk behaviour, risk culture, the ability to identify, analyze and respond to risks, and develop and apply the risk management process. The overall ability of subway contractors to manage risks was between the low and the average level. The most mature indicator was the ability to analyze risks, and the least mature one was risk management behaviour [26]. El-Sayegh (2014) also evaluated current risk management practices in the United Arab Emirates through a questionnaire distributed to specialists, which found that respondents frequently implement risk management processes, especially risk identification and evaluation. In addition, there is research on the need to improve certain risk management practices, and their use is increasing [27]. Serpell et al. (2015) developed a risk management model and a tool to evaluate companies' risk management capabilities. The model and tool were applied to three companies. The research concluded that the

risk management maturity levels of the three companies were low, with an average of 2 on a scale of 1 to 4 [28]. Salawu et al. (2015) assessed risk management maturity of companies implementing highway rehabilitation projects in Nigeria, and it was found that the level of risk management maturity of companies was at the least limit, with a value of 0.389, in addition to the fact that the most mature characteristic was risk management resources, and the least mature one was the risk management process [29]. Al Faihan & Shaker (2015) evaluated the level of risk management in the project against the international standard ISO 31000:2009, as the Baghdad Governorate Building Project did not adopt modern risk management approaches. The results showed that risk management was not applied effectively and systematically within the company, leading to inconsistent risk management [30]. Bhosale et al. (2018) examined risk management practices implemented by companies and poor road contractors and found that the risk management model would help users improve their practices and raise awareness of it [31]. Bahamid et al. (2022) worked to evaluate current risk management practices in Yemen, and this article emphasized that risk management in Yemen was not implemented systematically, intentionally, or on a permanent basis. In addition, with no or limited resources allocated to risk management, most companies' procedures were interactive and semi-permanent, and these were informal and unstructured [32]. Many researchers have worked on measuring the level of risk management maturity in construction projects and companies using different models, but since there is no integrated model, which (1) takes into account all the factors that affect the risk management plan, (2) discusses each stage of risk management in an accurate detailed manner that ensures the effective implementation of each stage, (3) can be applied to construction projects and companies whatever size and type they are, and (4) depends on the latest version of the international standard ISO 31000:2018, this research is conducted aiming to (1) develop a model based on the ISO 31000:2018 that can evaluate risk management practices, (2) test it in a case study on "The General Company for Roads and Bridges" in Syria, and (3) identify the weaknesses to address and the strengths to enhance.

3. RESEARCH METHODOLOGY

3.1. Model Development

After conducting a precise study of the international standard ISO 31000:2018, a model has been proposed to measure the level of risk management practices in construction projects and companies. This model consists of two sections. The first section addresses the risk management framework and includes 18 sub-

items distributed across 11 main items (Fig. 1 shows the main items of the Risk Management Framework).



Fig. 1 Risk Management Framework [22].

The second section deals with the risk management process and consists of 29 sub-items distributed among 13 main items (Fig. 2 shows the main items of the risk management process). In Table 5 and Table 6, the third column contains the sub-items of the risk management framework and process. The proposed model has been applied on a case study of "The General Company for Roads and Bridges" in Syria in order to test it and confirm its effectiveness.

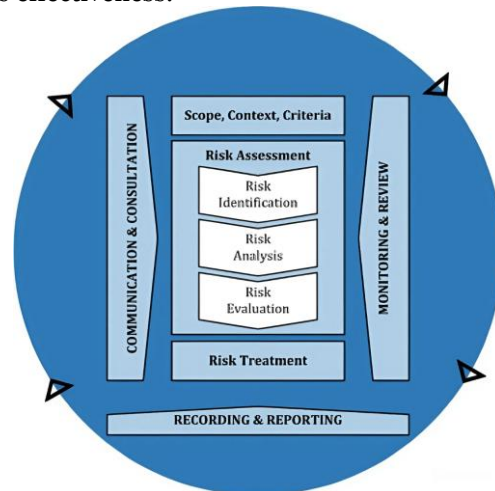


Fig. 2 Risk Management Process [22].

3.2. Data Collection

The data were collected through a questionnaire distributed to a sample of engineers working at the General Company for Roads and Bridges. A total of 45 responses have been collected from participants and deemed valid for analysis. The response rate has been 75%, which is considered a good rate given the sample size. The questionnaire consists of three sections. The first section includes personal information about the engineers, including their years of experience and fields of work. The second section covers the risk management framework, and the third section covers the risk

management process. The five-point Likert scale has been used in the questionnaire (very low=1, low=2, medium=3, high=4, very high=5), and the scale has been divided into domains according to the following Eq. (1):

$$\frac{\text{The domain length} = \text{number of distances}}{\text{number of options}} = \frac{4}{5} = 0.8 \quad (1)$$

The levels have been estimated as shown in Table 1:

Table 1 5-Point Likert Scale Ranges.

The Field	The Level
From 1 to 1.79	Very low
From 1.8 to 2.59	Low
From 2.6 to 3.39	Middle
From 3.4 to 4.19	High
From 4.2 to 5	Very high

3.3. Questionnaire Analysis

Cronbach's alpha was calculated for all 47 questionnaire items in SPSS, yielding 0.953 (see figure). This indicates excellent reliability and no need to modify the questionnaire.

Table 2 Reliability Statistics.

Cronbach's Alpha	N of Items
.953	47

Table 3 shows the distribution of engineers according to the number of years of experience:

Table 3 Distribution of Respondents According to Number of Years of Experience.

Number of Years Experience	Frequency	Percent
Less than 5 years	4	8.9
Between 5-10 years	8	17.8
More than 10 years	33	73.3
Total	45	100

We have noticed that the highest percentage of participants have more than 10 years of experience, which will be reflected in the credibility of the answers. As for the distribution of respondents according to their field of work, Table 4 shows that:

Table 4 The Distribution of Respondents According to the Field of Work.

Work field	Frequency	Percent
Design engineer	9	20
Supervisor engineer	7	15.6
Execution engineer	21	46.7
Project manager	8	17.8
Total	45	100

The largest percentage of participating engineers work in the field of execution, then the field of studies, and in third place are engineers working as project managers, while the smallest percentage of participants work as supervision engineers.

3.4. Evaluating the Company's Compliance with the Items of the International Standard ISO 31000:2018 (Framework)

The company's level of commitment has been measured against the provisions of the international standard ISO 31000:2018 (framework), namely "Leadership and Commitment", "Integration", "Design", "Implementation", and "Evaluation and Improvement". Table 5 shows the results obtained.

Table 5 Average Company Compliance and Relative Importance of the Items of the International Standard ISO 31000:2018 (Framework).

Sequence	Name and Number of the Main Item [22]	Sub-Items [22]	The Arithmetic Mean of the Sub-Item	The Arithmetic Mean of the Main Item	Relative Importance
1	5.2 Leadership and commitment	The company issues a statement or develops a policy or action plan outlining the risk management approach.	2.96	2.22	44.4%
2		The company allocates the resources required to manage risks.	2.87		
3		The company determines the type and degree of acceptable risk to help develop risk standard.	1.58		
4		The company periodically monitors risks.	1.84		
5		There is a regulatory body to monitor risk management.	1.87		
6	5.3 Integration	Every employee in the company has responsibility for risk management.	3.76	3.76	75.2%
7	5.4 Design	5.4.1 Understanding the organization and its context The company's internal and external work environment is evaluated and understood	3.67	3.08	61.6%
8		5.4.2 Articulating the risk management commitment The company confirms and declares its commitment to risk management	2.67		
9		5.4.3 Assigning organizational roles, The company determines the powers of employees in the regulatory body and delegates accountability to them	2.51		

		authorities, responsibilities and accountabilities				
10		5.4.4 Allocating resources	The company determines the required resources, whether in terms of individuals or in terms of experience and skill	3.31	2.86	
11			The company identifies and documents all processes, methods and tools available to it to manage risks	3.22		
12			The company identifies information and knowledge management systems	3.29		
13			The company identifies all the training and professional development needs of the risk management process.	1.6		
14		5.4.5 Establishing communication and consultation	A specific approach is adopted for communication and consultation within the company regarding the risk management process	3.69		
15	5.5 Implementation		The company ensures that its risk management arrangements are understood and its practices are clear	3.49	3.49	69.8%
16	5.6 Evaluation		The company evaluates risks periodically	1.38	1.38	27.6%
17	5.7 Improvement	5.7.1 Adapting	The company constantly monitors the risk management plan	1.42	1.38	27.6%
18		5.7.2 Continually improving	The risk management framework is constantly improved the company and its suitability and effectiveness are ensured	1.33		

Leadership and Commitment: Calculating the arithmetic average for the Leadership and Commitment item yields a value of 2.22, indicating a decline in the company's commitment to this item. By observing the arithmetic average of the questions, we have noticed that the first question has a value of 2.96, which is an average, but it indicates that the company does not develop an integrated plan to manage the risks it faces during project implementation. The same thing applies on the second question. It obtained an arithmetic average of 2.87. Therefore, the company must allocate resources more effectively to manage risks. As for the third question, the arithmetic average was 1.58, a very low value. Therefore, the company must clearly define the acceptable degree and type of risk to help develop risk standards. As for the rest of the questions allocated to this item, the fourth and fifth questions have the following two values, respectively: 1.84 and 1.87, which are low values indicating the need for more regular risk control processes.

Integration: The arithmetic average for this item has been 3.76, which is a high value. It indicates that engineers, whose job positions relate to risk management, carry the responsibilities required of them to a large extent, and that the roles of all employees in the field of risk management need to be defined, not limited to certain levels within the company.

Understanding the Organization and its Context: The arithmetic average value of the question expressing this item has been 3.67, which is a high value. It indicates the employees of The General Company for Roads and Bridges'

understanding of their field of work, whether within the company or its affiliated projects.

Articulating the Risk Management Commitment: The value for this item is 2.67, which is an average. It indicates the company's keenness to manage most of the risks it is exposed to, and the need to develop this process into an integral part of the company's project management.

Assigning Organizational Roles, Authorities, Responsibilities and Accountabilities: 2.51 is the arithmetic average value for the only question on this item. It is a low value that indicates the need to develop the work of employees responsible for monitoring risks and improving their performance.

Allocating Resources: Although Questions 10, 11, and 12 have values of 3.29, 3.22, and 3.31, respectively, which are average values, they reflect the company's interest in allocating the necessary resources to address risks, whether in terms of individuals, their experience, and skill, or in terms of the used methods and tools. But Question 13 has revealed a severe weakness in the company's training and professional development required by the risk management process, as the arithmetic mean was 1.6, leading to the item obtaining an average value of 2.86.

Establishing Communication and Consultation: This item has a value of 3.69, which is a high value. It indicates the company's keenness to consult and communicate among employees on risk management.

Implementation: Its high value of 3.49 indicates that the company is keen to ensure that the arrangements in risk management are understood and that the methods for implementing them are clear.

Evaluation: During the company's interviews, we have noticed a lack of commitment to periodic risk assessment, to a large extent, and its shortening to certain stages of project implementation. This has been confirmed by the very low arithmetic average for this item, which is 1.38.

Adapting: Its value has been 1.42, which is very low. It indicates the company's weak commitment to this item, as there is a weakness in monitoring processes over risk management plans.

Continually Improving: This item has the lowest arithmetic average of 1.33. This very low value indicates a major problem: the company lacks "Continually Improving" processes for risk management frameworks to ensure its consistency with the company's plans and the ability to achieve its desired goals. Therefore, the arithmetic average of the company's commitment to the framework provisions is 2.64, corresponding to a percentage of 52.8%.

Moreover, by analyzing the relative importance values of the main items, it becomes clear that the company focuses more on "Integration" and "Implementation", while "Evaluation" and "Improvement" have received the lowest percentages, indicating a critical weakness in the continuity and development of the risk management framework.

3.5. Evaluating the Company's Compliance with the Items of the International Standard ISO 31000:2018 (Process)

In this paragraph, the company's level of commitment to the provisions of the international standard ISO 31000:2018 (Process) has been determined. They are "Communication and Consultation", "Scope, Context and Criteria", "Risk Assessment", "Risk Treatment", "Monitoring and Review", and "Recording and Reporting". Table 6 shows the results obtained.

Table 6 Average Company Compliance and Relative Importance of the Items of the International Standard ISO 31000:2018 (Process).

Sequence	Name and Number of the Main Item [22]	Sub-Items [22]	The Arithmetic Mean of the Sub-Item	The Arithmetic Mean of the Main Item	Relative Importance
1	6.2 Communication and consultation	In the stages of the risk management process, the company works on communicating and consulting with all stakeholders, both internal and external.	3.73	3.73	74.6%
2	6.3 Scope, context and criteria	6.3.2 Defining the Scope	The Company defines the scope of all risk management activities to be undertaken.	3.89	65.4%
3		6.3.3 External and internal context	The company's internal and external work environment is determined for the risk management process	3.78	
4		6.3.4 Defining risk criteria	The company determines the amount and type of risks that are considered or not taken in relation to its objectives.	2.62	
5			The company determines a method for measuring the likelihood of risks occurring and the severity of their impact.	1.31	
6			The company's ability to put procedures in place to address risks is taken into consideration when determining the criteria.	2.51	
7	6.4 Risk assessment	6.4.1 General	The company evaluates risks systematically, periodically and jointly.	1.42	44%
8		6.4.2 Risk identification	When determining risks, the company considers potential threats and opportunities	3.69	
9			When identifying risks, the company considers weaknesses and available capabilities	3.62	
10			When identifying risks, the company considers the possible consequences and their impact on the objectives	3.8	
11			When determining risks, the Company considers time-related factors	3.96	
12		6.4.3 Risk analysis	When analyzing risks, the company considers the efficiency of the currently existing control systems	1.67	
13			When analyzing risks, the Company takes into account the probability of events occurring	1.29	

14			When analyzing risks, the company considers the nature and extent of the risks	1.87			
15			When analyzing risks, the company considers factors related to time and their changes	2.2			
16		6.4.4 Risk evaluation	The results of the risk analysis obtained by the company are compared with the established risk standards	1.49	1.83		
17			The company records the results obtained from the risk assessment and shares them with the various levels	1.56			
18			As a result of the evaluation, the company decides to either do nothing, take a treatment option, re-analyze the risks to understand them better, or maintain existing systems of control.	2.44			
19	6.5 Risk treatment	6.5.1 General	The company prepares and chooses risk treatment methods	3.82	3.39	2.76	55.2%
20			The company prepares and implements plans to address risks and verifies the efficiency of treatment procedures	3.76			
21			If risks remain unaddressed, the company decides to accept them or not	3.11			
22			If the remaining risks are not accepted, the company will determine the treatment options	2.87			
23		6.5.2 Selection of risk treatment options	The company considers the performance of its stakeholders when processing	2.96	2.16		
24			The company constantly monitors and reviews the handling of remaining risks	1.84			
25			If there are risks that have no treatment method, the company documents them and conducts a permanent review of them	1.69			
26		6.5.3 Preparing and implementing risk treatment plans	Risk treatment plans are integrated into the company's plans and operations, in coordination with stakeholders	1.53	2.72		
27			The risk treatment plan includes the logical standard for making the decision to choose treatment options, who is responsible for approving the plan, who will implement it, and the steps required for that, in addition to resources, performance measures, limits, reporting, monitoring, and the time required to implement the required steps.	3.91			
28	6.6 Monitoring and review	The company constantly monitors all stages of the risk management process		1.96		1.96	39.2%
29	6.7 Recording and reporting	The company deters the reporting method		3.62		3.62	72.4%

Communication and Consultation: This item has got a value of 3.73, which is a high value. It indicates the company's keenness to continually communicate with all stakeholders, whether internal or external.

Defining the Scope: The arithmetic average for this item is 3.89. This high value has been confirmed by all interviews with engineers within the company, as everyone is familiar with the activities of the risk management process to be implemented.

External and Internal Context: The high value of this item, amounting to 3.78, confirms the company's commitment to it and the company's identification of the environment in which the risk management process is to be implemented.

Defining Risk Criteria: This item has a value of 2.15, indicating a defect in the process for defining risk criteria.

Risk Assessment (General): The value obtained for this item, amounting to 1.42, reflects a weakness in the risk assessment process as it is not conducted in a thoughtful and organized manner according to the time programs set for it.

Risk Identification: This item has a high value of 3.77, indicating that the company is highly committed to meeting the requirements for achieving this item. The company takes into account, in the process of identifying risks, the obstacles it may face or the possible opportunities, in addition to the size of the existing capabilities and deficiencies, and the impact of the obstacles on the set goals, noting the company's interest in the aspect related to the impact of risks on time, as this will reflect negatively on the company's plans.

Risk Analysis: This item has a very low value of 1.76, while Questions 12 and 13 have 1.29 and 1.67, respectively. These very low values reveal the failure to take the efficiency of regulatory systems into consideration when analyzing risks, in addition to weakness in determining the probability of risks occurring when analyzing risks, as well as the two questions 14 and 15 have obtained values of 1.87 and 2.2, respectively. These low values are due to the company's weak consideration of the nature and size of risks when analyzing risks and factors related to time and their changes.

Risk Evaluation: The arithmetic average for this item is 1.83, and this low value is due to Questions 16 and 17 receiving 1.56 and 1.49, respectively. These values are classified as very low. They are a result of the lack of interest in comparing the risk standards the company sets, as well as the lack of commitment to recording the results of the Risk Assessment process and sharing them across levels. Question 18 of this item has a score of 2.44, which is a low value indicating weakness in handling the outcomes of the Risk Assessment process, as well as a defect in its application.

Risk Treatment (General): 3.39 is the value for this item, which is high. Questions 19 and 20 have values of 3.76 and 3.82, respectively. These values are considered high, as confirmed by the project documents reviewed. The Roads and Bridges Company has chosen the method to be followed in dealing with risks, developed a detailed plan to implement the proposed method, and ensured that the required goal is achieved. Questions 21 and 22 have values of 2.87 and 3.11, which are average values that reflect a partial commitment by the company to address the remaining risks, along with the need to improve the company's performance in handling these details.

Selection of Risk Treatment Options: This item has got a value of 2.16, which is a low value, though Question 23 has got a value of 2.96, which is an average value indicating that the company takes into account the performance of the people working in it, while the Question 24 has got a low value of 1.84, which indicates a lack of regularity in monitoring and reviewing remaining risks according to periodic programmes. As for the last question in this item, it has a value of 1.69, which is very low, indicating weakness in documenting the review of risks with no treatment method.

Preparing and Implementing Risk Treatment Plans: This item has an average value of 2.72. This is due to the fact that Question 26 has got a value of 1.53, which is a very low value that indicates an urgent need to integrate plans and methods for treating risks with the company's plans in coordination with stakeholders, while Question 27 has got a high value of 3.91 which demonstrates the company's endeavor to

adhere to the integrated preparation of the Risk Treatment Plan.

Monitoring and Review: This item has a value of 1.96, reflecting the lack of continuous monitoring across all stages of the risk management process. Monitoring operations are limited to only parts of it.

Recording and Reporting: The high value of this item, at 3.62, reflects the company's clear commitment to preparing reports on the various activities under the Risk Management Plan and their requirements.

Based on the above, the arithmetic average of the company's commitment to the process terms is 2.78, which is also the average and represents 55.6%. Moreover, analyzing the relative importance values highlights that the company places higher emphasis on "Communication and Consultation" and "Scope, Context and Criteria", while items such as "Monitoring and Review" and "Risk Assessment" have the lowest percentages, revealing critical areas that need more attention to strengthen the risk management process.

4.DISCUSSION

By reviewing the results of our discussion on the general company for roads and bridges' commitment to ISO 31000:2018, we find that these items are divided into four levels. The first level includes the "Continually Improving" item, which is the item that has the lowest value in the Arithmetic Average. Also, the "Evaluation" and "Adapting" items are the Commitment category items classified as very low. The level of the company's commitment to these items makes it unable to deal effectively with the risks it faces, and that is because of the lack of monitoring of the risk management plan, and the systematic evaluation of the risk, in addition to the weakness of the improvement processes on the Risk Management Plan. For the second level, it has included the "Leadership and Commitment" item and "Assigning Organizational Roles, Authorities, Responsibilities and Accountabilities" item. The company's commitment to these items has been classified as low, whereas its commitment to the third level, which includes the items "Articulating the Risk Management Commitment" and "Allocating Resources", has been classified as average. The company's commitment to the fourth-level items has been classified as high. Its items are "Implementation", "Understanding the Organization and its Context", "Establishing Communication and Consultation", and "Integration" (this last one has the highest value of the Arithmetic Average). Regarding the process items, they have also been divided into four levels. The first level, which is very low, includes the "Risk Assessment (General)". It is the item that has the lowest value of the process items. It is followed by the "Risk Analysis" item. The company's weak commitment to these two

items is considered a major obstacle to the risk management process, as they play a role in the decision-making process to determine procedures for dealing with risks. The weak result of the company's commitment to the "Risk Analysis" item has been the same with the findings of Research [24], where the weakest feature has been "Risk Analysis", also with Research [31], which has showed through a case study that the practices of "Risk Assessment"/"Risk Analysis" have been very low. The second level contains items for "Risk Evaluation", "Monitoring and Review", "Defining Risk Criteria", and "Selection of Risk Treatment Options". They have all been classified as having low commitment. The third level includes items for "Preparing and Implementing Risk Treatment Plans" and "Risk Treatment (General)". The company's commitment to them has been classified as average. And the fourth level has included items to which the company's commitment has been high. They are "Recording and Reporting", "Communication and Consultation", "Risk Identification", "External and Internal Context", and "Defining the Scope" (this last one has the highest value among the process items). Compared to the items of the ISO 31000:2018, we find that the company's average commitment to them has been 2.71, which is an average value and a percentage of 54.3%. This clearly reflects the random risk management practices, which require developing a plan to raise the level of risk management maturity in the company, starting with the items where the level of the company's commitment has been very low." The Study [24] indicates that the level of risk management maturity has been relatively low in the Australian construction industry. The Study [26] has assured that the level of risk management maturity is between low and average for subway project contractors in China. The Study [29] has shown that the level of risk management maturity has been "novice" in companies implementing highway rehabilitation projects in Nigeria. Also, the risk management practices of road construction companies in India, especially road contractors, have been very poor [31]. The questionnaire participants have confirmed that the model developed during the research is simple and easy to use. This model's assessment of the level of risk management in construction projects and companies is considered more accurate and transparent, because it includes all the factors that affect the stages of risk management, and this is showed in the 47 sub-items that cover all details of the risk management plan, and are not included in any models that have been proposed by many previous studies. For example, the Studies [24, 26] have not

indicated these factors: (1) conducting periodical monitoring for the risks by the company; (2) having a monitoring body to monitor risk management; (3) evaluating and understanding the company's internal and external work environment; (4) improving risk management framework constantly by the company and making sure of its suitability and effectiveness; (5) defining the scope of all risk management activities to be undertaken by the company; that are in addition to taking into account the followings when identifying risk standards: (6) the company's ability to establish treatment procedures; (7) the potential threats and possible opportunities; (8) the weaknesses and available capabilities; (9) the possible consequences and their impact on the objectives; and (10) the time-related factors; (11) Comparing the results of the risk analysis obtained by the company are with the established risk standards; (12) if risks remain unaddressed, the company makes a decision to accept these risks or not; (13) if the remaining risks are not accepted, the company determines the treatment options; (14) when processing, the company takes into account the performance of its stakeholders; and (15) the company also determines the reporting method of risks. In addition, the model presented by the Study [24] has not referred in any of its main items to the risk response stage, and its sub-items are unable to measure it adequately, despite the importance of this stage, where the outputs of the stages of identifying, analyzing, and evaluating risks will be relied upon in making decisions on the method of handling risks. The model presented in this research measures the level of practices at the stage of risk response using 11 sub-items. In addition, the study [28] has addressed the risk management process in only 4 sub-items. The study could not provide a complete and accurate picture of the level of the company's commitment to the terms of the risk management process, whereas the model developed during the research measures the risk management process through 29 sub-items. To analyze the relationships among the items of the international standard ISO 31000:2018 and determine the strength of these relationships and the role that these items can play in improving the performance of The General Company for Roads and Bridges in dealing with risks, a correlation analysis has been performed using Spearman's Test. The correlation coefficient (r) indicates the strength of the relationship between the items, and its value ranges from -1 to +1. The statistical significance (p) indicates how strong the relationship is; a relationship is considered significant if $p < 0.05$.

Table 7 Analysis of the Most Significant Correlation among the Items of the International Standard ISO31000:2018 in the Company.

First Item	Second Item	Spearman's Correlation Coefficient (r)	P-Value	Strength of Relationship
Integration	Implementation	0.813	0.000	Very strong
Communication and consultation	Risk treatment	0.803	0.000	Very strong
Scope, context and criteria	Design	0.726	0.000	Strong
Scope, context and criteria	Implementation	0.692	0.000	Strong
Communication and consultation	Implementation	0.695	0.000	Strong
Integration	Risk treatment	0.740	0.000	Very strong
Leadership and commitment	Integration	0.417	0.004	Moderate
Integration	Communication and consultation	0.773	0.000	Very strong
Scope, context and criteria	Communication and consultation	0.663	0.000	Strong
Design	Communication and consultation	0.638	0.000	Strong
Leadership and commitment	Design	0.558	0.000	Moderate
Evaluation	Improvement	0.322	0.031	Weak

Based on the results in Table 7, the analysis of the relationships among the international standard ISO 31000:2018 highlights the strengths and weaknesses of the risk management practices of The General Company for Roads and Bridges, which provides a comprehensive vision for the development of the company's risk management strategies. The relationship between "Integration" and "Implementation" indicates that integrating departments within the company is essential to ensuring the effective implementation of risk management strategies. The high value of the correlation coefficient ($r=0.813$) confirms that the current level of integration plays a key role in achieving operational process efficiency. The relationship between "Communication and Consultation" and "Risk Treatment" expresses the importance of internal communication in improving the efficiency of risk treatment. The value of the correlation coefficient ($r=0.803$) indicates that the development of open and effective communication channels among departments in the company can enhance the ability to make more informed risk management decisions. As for the relationship between "Scope, Context and Criteria" and "Design", it underscores the role and importance of defining scope, context, and criteria in improving the development of a plan and the stages of the risk management process. The value of the correlation coefficient ($r=0.726$) reflects the importance of clarity in requirements and standards within the company in designing and developing an appropriate, flexible plan for the stages of the risk management process. The relationship between "Integration" and "Risk Treatment" shows that integrating processes enhances the effectiveness of risk management strategies, as evidenced by the correlation coefficient ($r=0.740$). This highlights the importance of continuous coordination among departments to develop effective risk treatments. Regarding the relationship between "Evaluation" and "Improvement", the company faces clear challenges in translating evaluation results into sustainable improvements. The value of the correlation coefficient ($r=0.372$) indicates an

urgent need to develop integrated assessment systems that translate outputs into practical actions.

5. CONCLUSIONS

Based on the results obtained, the research recommends the following:

- Adopting the proposed model based on the research as a basis for evaluating risk management practices implemented within construction companies allows for the identification of areas of deficiency, provides the opportunity to work on improvement processes and helps companies obtain the ISO 31000:2018 certificate.
- In order to raise the level of awareness of the culture of risk management, employees, within the General Company for Roads and Bridges, they must be informed of the stages of the risk management process and how to conduct each stage, and make them aware of the benefits of implementing the risk management plan within the company, whether in terms of cost, time or quality.
- Since the procedures followed do not rise to the level of an integrated risk management plan, it is necessary to have a specialized department within the company for risk management that works to study each division of the company, determines the operations it conducts and the risks it may face, and it must set a risk management plan for each division to be a part of a comprehensive plan for the whole company.
- Establishing a central database for risk management under the supervision of the department mentioned in item No. 2, linked to each department of the company, with the aim of benefiting from previous experiences that the company has faced.
- Working to incorporate modern technologies, such as Building Information Modelling (BIM), in the risk management plan within the projects implemented by the General Company for Roads and Bridges.

6. ACKNOWLEDGEMENTS

The authors would like to thank the University of Tishreen for their support.

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