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# Developing Crisis Management System for Construction Projects in Iraq

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## ABSTRACT

Construction is a complicated process that takes place in an almost uncontrollable environment. Although projects can be carefully planned in advance in principle, there is a chance that unforeseen events and crises can disrupt these plans, affecting project development. Because the initial investment expenditures in construction projects are so large, they may be quickly influenced by crises, resulting in significant financial losses. The 2014 financial crisis was one of the most prominent crises that Iraq faced, which significantly impacted various activities in general and the construction industry in particular. Despite the importance of crisis management systems, the researchers found a great lack of local studies looking at crisis management, specifically in the basic stages chosen for its development, which are before, during, and after a crisis. Therefore, an effective crisis management system has been developed consisting of 20 critical success factors with devising 59 actions that can be taken for each proposed criterion for each of the three stages of crisis.

**Keywords:** Crisis, Economic Crisis, Recession, Crisis Management, Construction Projects, Effects, Procedures

# تطوير نظام ادارة ازمات للمشاريع الانشائية في العراق

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## الخلاصة

البناء هو عملية معقدة يحدث في بيئة لا يمكن السيطرة عليها تقريبًا. و على الرغم من أنه يمكن التخطيط بعناية للمشاريع مسبقًا من حيث المبدأ ، إلا أن هناك فرصة ان تؤدي الأحداث والأزمات غير المتوقعة الى تعطيل هذه الخطط ، مما يؤثر على تطوير

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المشروع. نظرًا لأن نفقات الاستثمار الأولية في مشاريع البناء كبيرة جدًا ، فقد تتأثر سريعًا بالأزمات ، مما يؤدي إلى خسائر مالية كبيرة. كانت الأزمة المالية لعام 2014 من أبرز الأزمات التي واجهها العراق والتي كان لها تأثير كبير على الأنشطة المختلفة بشكل عام وصناعة البناء بشكل خاص. على الرغم من أهمية أنظمة إدارة الأزمات ، وجد الباحثون نقصًا كبيرًا في الدراسات المحلية التي تبحث في إدارة الأزمات ، وتحديداً في المراحل الأساسية التي تم اختيارها لتطورها ، والتي كانت قبل وأثناء وبعد الأزمة. لذلك ، تم تطوير نظام فعال لإدارة الأزمات يتكون من 20 عامل نجاح حاسم مع استنباط 59 إجراء يمكن اتخاذها لكل معيار مقترح لكل مرحلة من مراحل الأزمة الثلاث.

**الكلمات الرئيسية:** أزمة ، أزمة اقتصادية ، ركود ، إدارة الأزمات ، مشاريع البناء ، الآثار ، الإجراءات

## 1. INTRODUCTION

Construction is a complicated operation that takes place in an uncontrolled environment. Construction projects are diverse and complex because they involve a variety of stakeholders (clients, designers, contractors, suppliers, and so on) who are attempting to complete multiple stages of the project (planning, design, operation, and maintenance) using a variety of methods and materials (concrete, cement, wood, steel) while consuming a large number of resources **(Sfakianaki, 2015)**. Although projects can be carefully planned in advance in principle, there is always the risk of unforeseen occurrences and crises disrupting plans, which will impact project development **(Sfakianaki et al., 2015)**. Because the initial investment expenditures in building projects are very large, a crisis can readily hit construction businesses, resulting in significant financial losses. A crisis is an unanticipated incident in an organization's life that poses a serious threat to its core principles and necessitates a quick reaction **(Supriadi, et al., 2018)**. It's also a situation that an individual, a group, or an organization cannot deal with using normal routine processes. Unpredictable occurrences and unexpected effects might lead to a crisis.
Furthermore, it is described by **(Babu et al., 2016)** as a moment of abrupt transition in which a completely new system emerges. Although crises have additional characteristics such as threat, suddenness, high uncertainty, urgency, stress and emotions, shortage of information resources, and destructiveness, they can provide opportunities if handled appropriately **(Kovoor-Misra, 2019) (Cao et al., 2017).** In 2009, the global economy was rocked by a serious financial crisis known as the global financial crisis, which impacted financial and national markets through the so-called mortgage or bad loan crisis, and its influence soon transferred to the economies of many nations due to globalization. According to **(Nafday, 2011)**, the construction industry is one of the most hit by the crisis and the subsequent recession.

### 1.1 Financial crisis impact on the construction industry

The construction sector is one of the most affected by the global financial crisis and the economic recession that followed. **(Kitching et al., 2009)** indicated that the global financial crisis that embraced banks and organizations in many countries of the world was the immediate trigger for the recession. A basic definition of an economic recession is a slowdown of economic activity as indicated by peak-to-trough declines. According to the widely used definition, a recession is defined as two consecutive quarters of decreasing gross national production. An economic recession affects various stakeholders of a firm, including employees, managers, partners, customers, suppliers, company shareholders, and the community at large. Recessions in the construction sector have the impact of lowering the resources available to companies as consumers purchase less, financiers cut down on financing, and competition rises **(Tansey et al., 2013)**.

Funding is one of the most important elements of project management. Without funding, no matter how well the scheduling, teamwork, and engineering are, the project will not work properly. However, lagged impacts, shrinking market, tight margins, fierce competition, hard to secure finance, employee turnover, and escalation of trade costs were among the main challenges to the construction market due to the global financial crisis that was referred by **(Zuo et al., 2015)**. The study prepared by **(O. I. et al., 2018)** also concluded that ( high rate of unemployment), (high rate of bankruptcy), (reduction in mortgage lending rate), (fluctuation in the cost of transportation and distribution), (fluctuation on the cost of raw materials), (unbearable credit conditions), (high rate of rehabilitation and maintenance works), (construction companies face finance problems), (loss of confidence in future market prospects), and (contraction in the new house building segment), were among the most important negative effects on the construction industry as a result of the economic recession. **Fig. 1** shows the mechanism of bankruptcy of construction companies. Because of the economic crisis, there is usually a significant decrease in public and private demand for projects, which leads to increased competition. Increased competition, in turn, leads to lower profit margins. On the other hand, the insolvency or bankruptcy of the state with regard to project payments, in addition to the incorrect management of construction companies in the years preceding the crisis, and the tightening of bank lending leads to a stifling shortage of liquidity for many companies. Finally, the deadly combination of consecutive non-profitable projects and lack of cash is the reason why many construction companies went bankrupt during the crisis **(Barmpas, 2018)**.

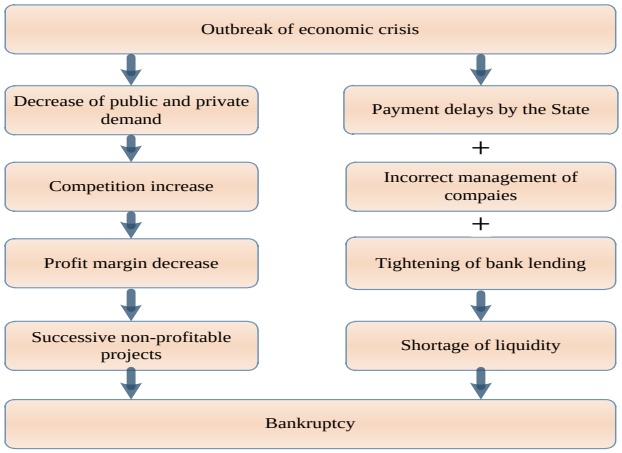


**Figure 1.** Bankruptcy mechanism of construction companies.

### 1.2 Crisis Management in Construction Projects

The goal of crisis management is recognizing, reaction organizing, confronting, and resolving the crisis in a dynamic and ongoing process involving both proactive and reactive activities **(Srinivasan, N.P. 2015)**. **(Cao et al., 2017)** denotes a specific management approach that requires a critical choice or reaction to be made in a short amount of time to improve pre-crisis foreseeing, in-crisis rescue, and post-crisis recovery abilities. Crisis management, like risk management, is a preventative treatment system that is put in place in advance of unforeseen occurrences that threaten public lives and property, social order, and public security, requiring managers to take necessary actions to reduce the losses. The goal of crisis management is not to completely prevent crises, but to limit bad consequences, have rapid and high-quality responses, and be as prepared as possible for all sorts of crises. Because the initial investment expenditures in building projects

are very large, a crisis can readily hit construction businesses, resulting in significant financial losses. As a result, construction businesses must continually assess their internal and external environments, recognize early warning signs to be prepared for crises, and fight effectively during a crisis to ensure their existence **(Babu et al., 2016)**. Companies that can successfully manage a crisis and emerge from it with zero or minimal harm may have strategic advantages over current competitors. There are a dozen research articles on crisis management in the construction management literature. However, **(Sahin et al., 2015)** argued that these studies were far from investigating the management practices of construction firms in the crisis process. The specific view is also supported by **(Öcal et al., 2006),** who mention that literature regarding economic crisis in construction is even more limited.

1.2.1 Crisis management models in construction projects

Crisis management may be better understood using a conceptual framework that views crisis management as a cyclical phenomenon with several stages. The **(Loosemore, 2000)** model shown in **Fig. 2** can be considered one of the first models for managing crises in construction projects. It isolates a series of distinct but interrelated phases of activity, each of which must be performed effectively if the overall crisis management process is to be effective. The model consists of seven stages, which are: detection, diagnosis, decision making, implementation, recovery, and learning.

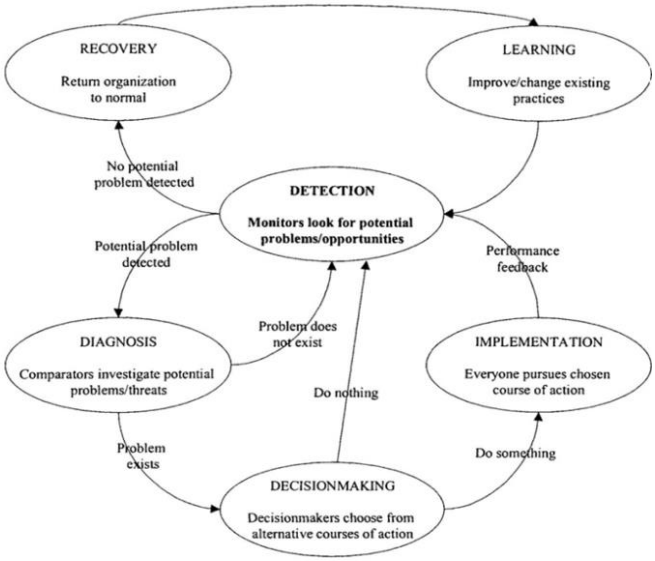


**Figure 2.** Crisis Management Model.

Also, the model proposed by **(Sfakianaki et al., 2015)** consists of five stages shown in **Fig. 3**, in addition to twelve activities. The first activity begins with the company's economic analysis, which helps to adapt to the latest changes based on the information collected so that the company reorganizes operations or individuals with the new market environment. Thus, the company is ready to discover any growth opportunities. Therefore, potential plans can be examined and considered for future application. Using brainstorming, solutions are proposed, and the most appropriate ones are selected to begin the process of implementing the plan after conducting the necessary exercises.


**Figure 3.** The proposed crisis management framework in construction.

Furthermore, the **(Barmpas, 2018)** model included four basic elements for dealing with the economic crisis from the perspective of project management. The model shown in **Fig. 4** clearly defined who should do what and how and when they should do it. The form also assigned specific procedures to specific people within a specific time frame, explaining at the same time how to implement these procedures.

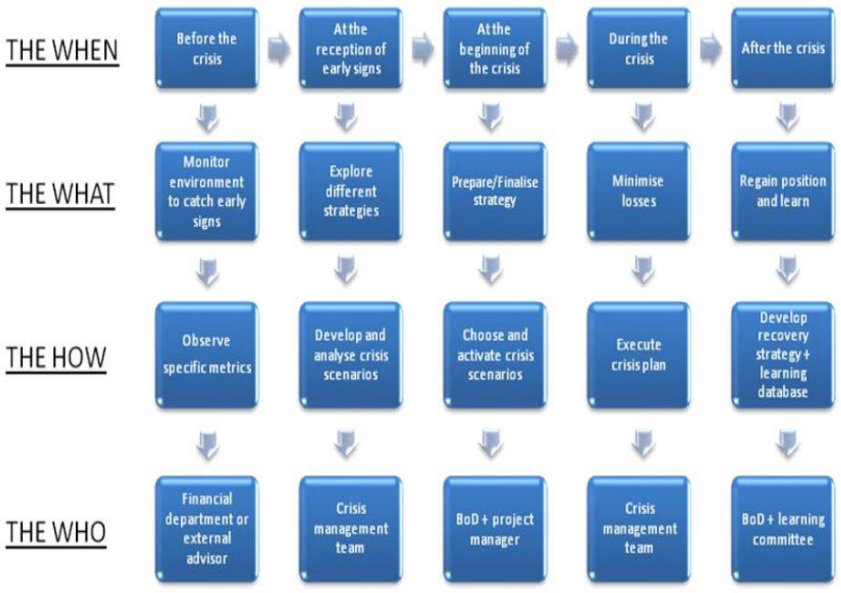


**Figure 4.** The recommended approach for confronting economic crisis conditions in terms of project management.

## 2. METHODOLOGY

The researcher visited many state departments and government institutions in addition to public construction companies to discuss the importance of the subject of the study and to know the most critical success factors that must be studied and which experts believe have an important role in developing the crisis management system for the Iraqi construction sector. The practical aspect of the research included two main axes. The first axis included general information about the respondents, while the second axis included identifying the importance degree of the critical success factors. A closed questionnaire of two parts is designed and built based on information gathered through literature review and experts interviews. The questionnaire was designed according to the five Likert scales and in proportion to each of its parts. The survey relied on the public-sector engineers that are involved in construction building activities and affiliating the Ministry Construction and Housing and Public municipalities such as: [Eight of the general construction contracting companies], [Housing Directorate]; [Buildings Directorate]; [Engineering Construction Office]; [The General Directorate of Sewage]; in addition to [The Ministry of Planning]. Separate questionnaire hard copies were used to deliver 151 questionnaire forms by hand. From the entire distribution, 116 survey questionnaires were returned. On the other hand, 110 questionnaires were returned, with six rejected due to incorrect survey sample, blank, illegible, or duplicated responses. The proportion of valid and returned surveys (94.82%) is deemed excellent for research purposes.

### 2.2. Mathematical and Statistical Methods Used in Data Analysis

The Statistical Package for Social Sciences (SPSS) V26 was used to conduct the analysis. The primary goal of these programs is to calculate descriptive statistics from the data collected. Before the data processing, a reliability test was conducted to ensure that the gathered data from a questionnaire survey was internally consistent. Cronbach's coefficient alpha (Cα) was used to determine inner consistency using Eq. (1) **(Prakash Rao, 2014)**. Cronbach's Alpha is a coefficient that ranges from 0 to 1, and it calculates the ratability ratio by approximating the correlation between averages of rating and internal constancy for each survey component **(Hamad and Ibrahim, 2020)**. According to the findings, Cronbach's Alpha coefficient for the questionnaire was 0.937. These values indicate the excellent reliability of the questionnaire.

$$C\alpha = \frac{k}{k-1}\left(1 - \frac{\sum_{i=1}^{k} \sigma^2 yi}{\sigma^2 x}\right) \quad (1)$$

Where K is the number of factors, $\sigma^2$x is the variance of total scores for the respondents and $\sigma^2$yi is the variance of component i for the respondents.

The data obtained were analyzed using the arithmetic mean (M) **(Raheem and Rezouki, 2020)**, standard deviation (S.D.) **(Mohammed and Jasim, 2017),** and relative importance index (RII) **(Rafidah et al., 2018)** as in Eq. (2), Eq. (3), and Eq. (4), respectively.

$$M = \frac{\left(\sum_{i=1}^{k} x_i \times f_i\right)}{n} \quad (2)$$

$$S.D = \left[\left(\sum_{i=1}^{k} (x_i - M)^2 f_i\right) / \left(\sum_{i=1}^{k} f_i\right)\right]^{1/2} \quad (3)$$

Where M is the arithmetic mean, S.D. is the standard deviation, $x_i$ the weight value for particular, the number of frequencies, and the total number of answers.

$$RII = \sum \frac{W}{A\,N} = \frac{5n_5+4n_4+3n_3+2n_2+1n_1}{5\,X\,N} \quad (4)$$

Where RII is the Relative Importance Index, W is the weighting as assigned by each respondent on a scale of 1 to 5 while 1 implies the least and 5 the highest, A is the highest weight, and N is the total number of the sample.

## 3. RESULTS AND DISCUSSION

### 3.1 General Information about Respondents

This part includes general information for respondents, including their academic degree, specialization, years of experience, and job position as follows:

**1. Fig. 5** shows the academic degree of the engineers who filled out the questionnaire form. It is important to observe that the highest percentage was (85.5%) of the engineers are holders of B.Sc. degree, 8.2% of the engineers are holders of M.Sc. degree, 3.6% of the engineers are holders of Ph.D. degree. In contrast, the lower percentage was 2.7% of the engineers who are holders of Diploma degree.

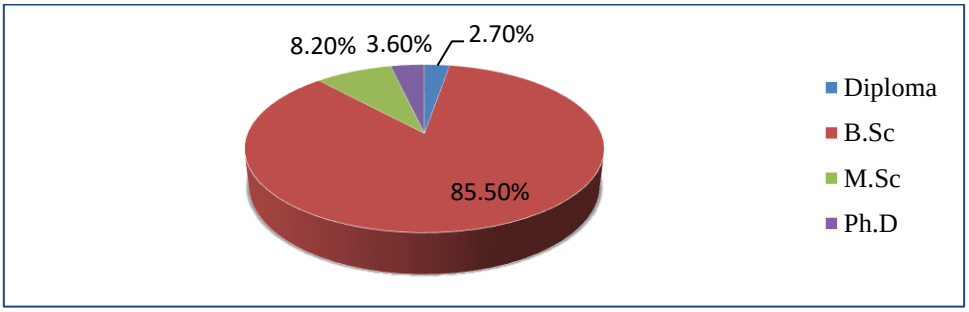


**Figure 5.** Academic Degree of respondents.

**2. Fig. 6** illustrates the percentage of engineers who filled out the questionnaire forms in the various engineering specializations. And it is concluded that the highest percentage was civil engineering (66.33%) of the data sample. In contrast, the other engineering specializations formed the remaining percentage as mechanical engineering, electrical engineering, architectural engineering, and others that represented (16.38%), (9.09%), (5.49%), and (2.7%) respectively of the data sample.

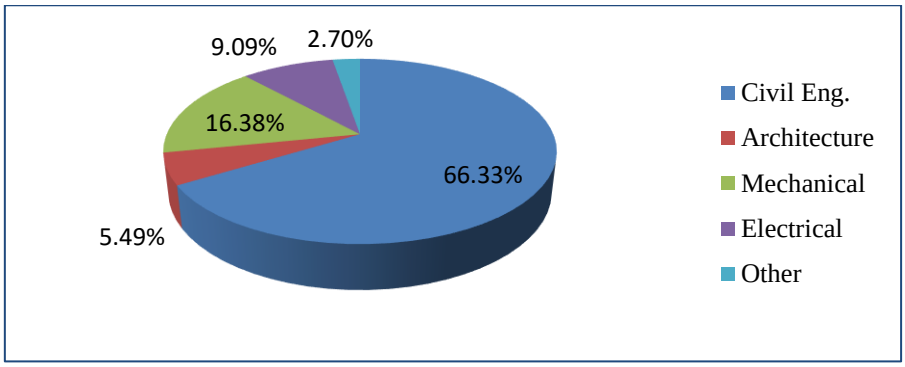


**Figure 6.** Engineering Specialization of respondents.

**3. Fig. 7** illustrates the experience in years of engineers who filled out the questionnaire form. It concluded that the most significant percentage of the research sample was (51.57%) for the engineers who have years of experience (more than 20 years), while the percentage of those with experience of 16-20 years was (27.27%). Followed by the engineers who have experience of between 11-15 years. The lowest percentage was (5.49%) for those with experience of between 6-10 years.

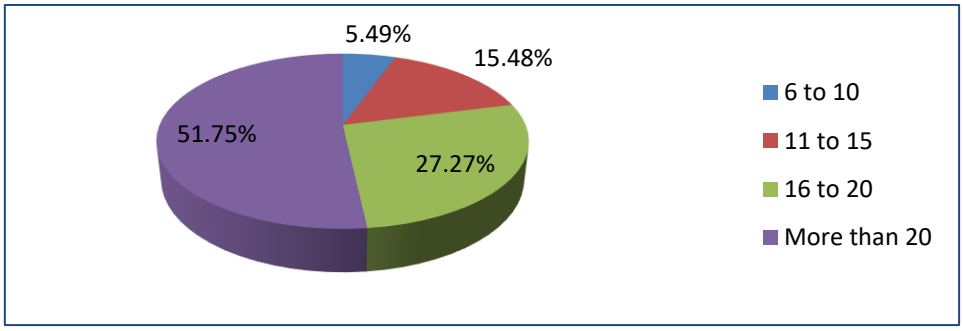


**Figure 7.** Years of Experience of respondents.

**4. Fig. 8** illustrates the current job position of engineers involved in the questionnaire form. It revealed that the highest percentage was (36.4%) for the senior chief engineer, the percentage was (29.1%) for the assistant chief engineer, and the percentage was (20.9%) for the chief engineer. In contrast, the percentage was (7.3%), (3.6%), (1.8%), (0.9%) for the senior engineer, engineer, other, and assistant engineer, respectively.

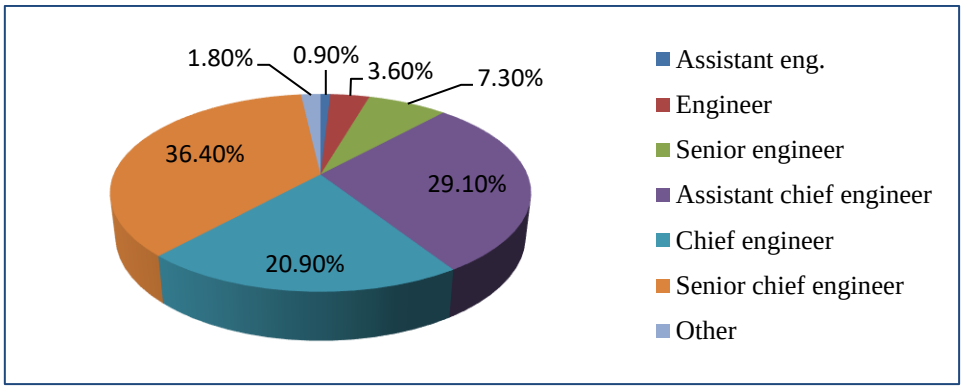


**Figure 8.** Current Job position of respondents.

## 4. PROPOSED CRISIS MANAGEMENT SYSTEM

### 4.1. Structure of the Model

Through previous studies related to crisis management, considering expert opinions, 20 critical success factors that affect crisis management in the Iraqi construction sector have been identified. The proposed system is divided into three stages: pre, during, and post-crisis. The pre-crisis stage is considered one of the very important and crucial stages in predicting, monitoring, and detecting any upcoming crisis, especially in the turbulent Iraqi environment. This stage consists of two parts, one complementing the other. The first part consists of (Developing an early warning system, senior management informed, and an effective information system), which are proposed to be implemented by the concerned regulatory authorities. In contrast, the second part consists of (Alert/warning signals receiving and crisis plans library creating) which must be implemented by the authorities responsible for construction projects. The model shows that the crisis moves from the pre-crisis stage to the acute stage when it becomes clearly visible to monitoring teams, executive management of the institution, the affected sectors, and all stakeholders, or through the receipt of official reports by the central crisis management team that clarify the inevitability of the crisis. At this time, the teams must take appropriate measures or methods to treat it effectively based on the plans that were thought and prepared before the crisis to mitigate its negative effects or try to get out of it with the least damage. This stage consists of two main activities; the first one is an emergency meeting of the crisis management team for construction projects, while the second is the implementation of the approved plan. Once the crisis has been addressed or passed, it is important to send follow-up communications to key stakeholders, ensuring that they are aware that the business is back to normal. During this stage, it is necessary to know whether any measures have been taken by the crisis management teams and identify them to start the three main activities that follow, which are the assessment of the crisis management plan, recovery, and finally, learning from the crisis. **Fig. 9** shows the structure of the proposed construction project crisis management system. A closed questionnaire was designed and presented to experts in the Iraqi construction sector to determine the importance of critical success factors contributing to the development of the proposed system. **Table 1.** shows the results of data analysis.

### 4.2 Procedures / Guidelines for the Proposed Crisis Management System

Given the importance of the proposed criteria according to the respondents' answers and to improve the degree of preparedness of the Iraqi construction sector to deal with crises. 59 effective measures have been proposed that require implementation by the responsible parties. **Tables 2, 3, and 4** show the proposed procedures in detail.

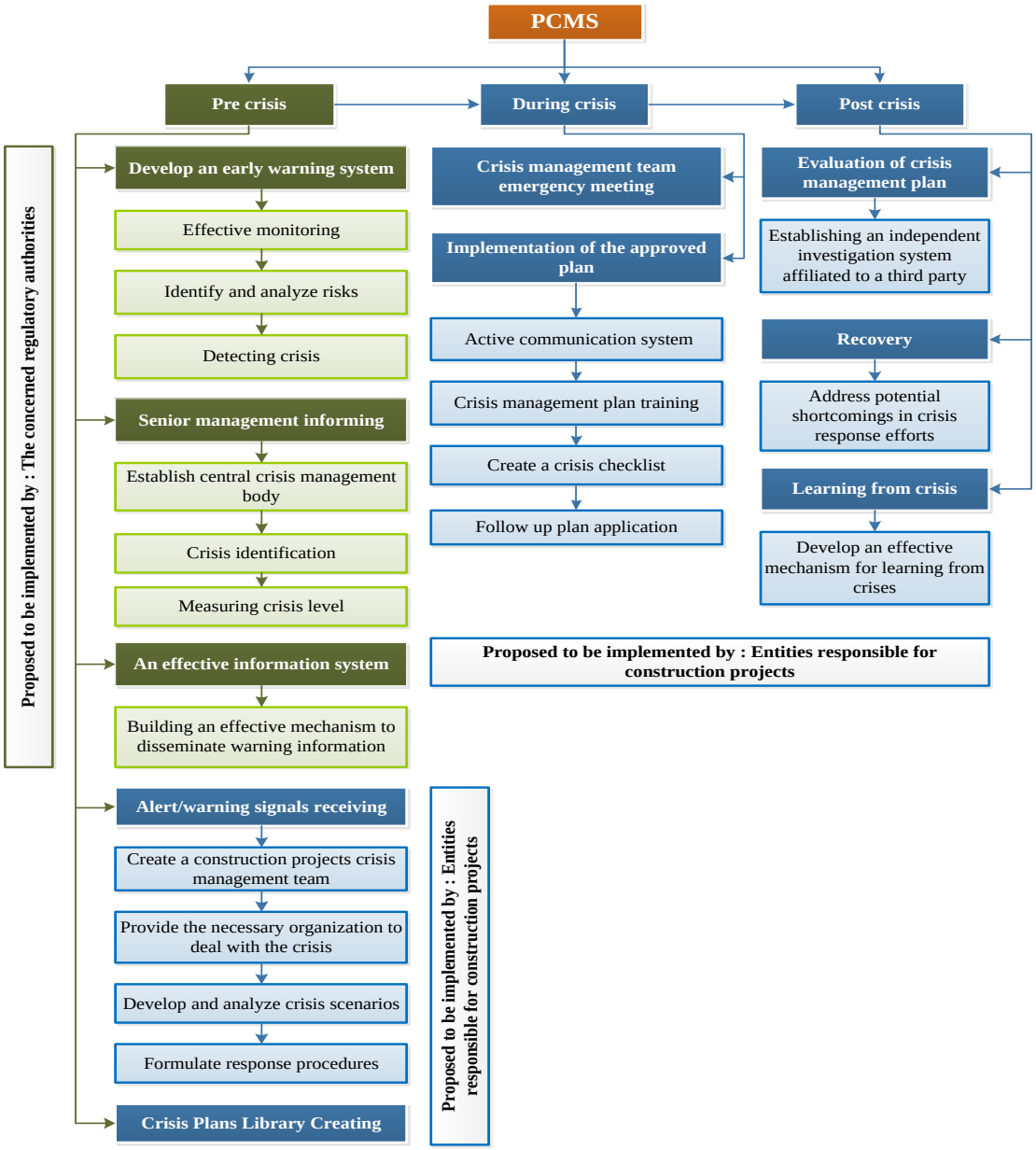


**Figure 9.** Structure of the proposed crisis management system.

**Table 1.** Suggested criteria for a crisis management system.

| Sub criteria | Main criteria | The entity responsible for the implementation | Stage | M | S.D. | RII | Rank |
|---|---|---|---|---|---|---|---|
| SC-1 | Develop an early warning system | | | 4.53 | 0.616 | 0.906 | 2 |
| SC-2 | | | | 3.75 | 0.683 | 0.75 | 18 |
| SC-3 | | | | 3.82 | 0.732 | 0.764 | 15 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| SC-4 | Senior management informing | The concerned regulatory authorities | Pre Crisis | 4.01 | 0.76 | 0.802 | 10 |
| SC-5 | | | | 4.3 | 0.724 | 0.86 | 5 |
| SC-6 | | | | 4.45 | 0.698 | 0.89 | 3 |
| SC-7 | An effective information system | | | 3.78 | 0.771 | 0.756 | 17 |
| SC-8 | Alert/warning signals receiving | Entities responsible for construction projects | | 4.1 | 0.741 | 0.82 | 8 |
| SC-9 | | | | 3.92 | 0.731 | 0.784 | 12 |
| SC-10 | | | | 3.9 | 0.69 | 0.78 | 13 |
| SC-11 | | | | 4.62 | 0.524 | 0.924 | 1 |
| SC-12 | Crisis plans library | | | 3.87 | 0.705 | 0.774 | 14 |
| SC-13 | The emergency meeting of construction projects crisis management team | | During Crisis | 3.75 | 0.71 | 0.75 | 19 |
| SC-14 | Implementation of the approved plan | | | 3.98 | 0.801 | 0.796 | 11 |
| SC-15 | | | | 4.26 | 0.738 | 0.852 | 6 |
| SC-16 | | | | 3.81 | 0.772 | 0.762 | 16 |
| SC-17 | | | | 3.73 | 0.765 | 0.746 | 20 |
| SC-18 | Evaluation of crisis management plan | | Post Crisis | 4.05 | 0.806 | 0.81 | 9 |
| SC-19 | Recovery after the crisis | | | 4.12 | 0.751 | 0.824 | 7 |
| SC-20 | Learning from crisis | | | 4.36 | 0.775 | 0.872 | 4 |

**Table 2.** Proposed procedures for pre-crisis stage.

| **Main/Sub criteria proposed to be implemented by: the concerned regulatory authorities** | | |
|---|---|---|
| **Develop an early warning system** | | |
| No | Sub criteria | Proposed procedures/guideline |
| 1 | Effective monitoring of the external environment by the concerned regulatory authorities or departments using the latest strategic analysis tools. | 1.1 Effective and continuous monitoring of Iraq's external environment by the departments concerned with the country's economic and financial policies.<br>1.2 Formation of a permanent committee of experts and internal or external consultants whose task is to assess the political, economic, social, and technological situation of the country according to certain indicators are determined using the latest strategic analysis tools such as PEST, in addition to scenarios planning workshops through which the possible changes that could occur in the current situation are predicted and identified to be compared with the data of previous/historical monitoring for each |

| | | |
|---|---|---|
| | | factor identified. |
| 2 | Determining and analyzing the risks resulting from the assessment of the political, economic, social and technological conditions. | 2.1 Identifying potential risks and opportunities resulting from situational assessments by using (PMI) tools such as [Documentation reviews, Information gathering techniques (Brainstorming, Delphi technique, interviewing or Root cause analysis), Checklist analysis, Assumptions analysis, Diagramming techniques, SWOT analysis, or Expert judgment].<br>2.2 Assessing the level of risks identified in terms of the probability and impact on the institution's strategic objectives, such as the objectives specified in development plans or allocated financial budgets, through conducting qualitative, quantitative analysis and consulting with specialized experts. |
| 3 | Existence of thresholds or limits through which the potential crises that the discovered risks could cause are sensed or discovered. | 3.1 Establishing a systematic or manual threshold through which to sense if any risk that exceeds the permissible limit to treat it through:<br>A. Standard processes systems and procedures if the risk is within the routine area.<br>B. Directing treatment procedures to improve management systems and procedures if the risk is within the problem area.<br>C. Taking detailed treatment action in the event of extreme risks.<br>3.2 Informing senior management of any risks that exceeded acceptable limits and that could turn into potential crises. |
| **Senior management informing** | | |
| 4. | Forming a central crisis management body by the higher management of the institution after being informed by the concerned regulatory authorities of the risks that may escalate into a crisis. | 4.1 Rapid senior/executive management interaction to form a central crisis management body.<br>4.2 Appointing a leading crisis management team that includes experts and specialists according to crisis type expected to be faced and appointing corresponding sub-teams, each with a special leader, that focuses on specific sectors or geographical areas depending on the severity and type of the crisis.<br>4.3 Design the appropriate legislative framework for forming and activating the main or subsidiary crisis management body for all affected areas.<br>4.4 Giving these teams sufficient authority to make a decision. |

| | | |
|---|---|---|
| 5. | Determining the type of crisis by the central crisis management body. | 5.1 Establishing a library, manual or systemic record in which all crises that have been previously encountered are documented in order to benefit from it in:<br>A. Determining the type of crisis based on or by searching its distinctive features and indicators by looking at the library of crisis cases that were previously encountered.<br>B. Resorting to manual identification by experts in cases of unique crises that have not been exposed before. |
| 6. | Measuring or determining the level of the crisis by the central crisis management body. | 6.1 Relying on a system or matrix that determines the level of the crisis according to certain criteria or characteristics that experts set for each level, thus finding the appropriate method of treatment according to its level, or it is possible to rely on four main criteria to define the crisis, including:<br>A. The level of threat that the crisis could cause.<br>B. Pressure of the time required to make a preventive decision.<br>C. Available response options under emergency conditions.<br>D. The degree of control over the situation. |
| **An effective information system** | | |
| 7. | An effective mechanism for disseminating warning information that transmits information related to crisis by the competent or concerned regulatory authorities to authorities/ parties/sectors responsible for construction projects. | 7.1 Adopting efficient, flexible, accurate, and interactive methods for transferring information to the relevant departments.<br>7.2 Release the warning information and signals to the parties expected to be affected in real-time and as quickly as possible to give them enough time to take their appropriate measures; this information could include: The type, level of crisis, the full extent of the accident, the areas or regions expected to be affected, what is being done currently, the possible cause and impact.<br>7.3 Attention to constantly modify the content of advance warning information with subsequent developments in events. |
| **Main/Sub criteria proposed to be implemented by: Entities responsible for construction projects** | | |
| **Alert/warning signals receiving** | | |
| 8 | Effective monitoring of the internal and external environments, which directly or indirectly affect the continued implementation of construction projects in Iraq before crisis. | 8.1 Monitoring the internal environment through continuous follow-up and review of reports related to the follow-up of the implementation of construction projects by the contracting authorities. |

| | | |
|---|---|---|
| | | 8.2 Monitoring the external environment by reviewing traditional media, newspapers, T.V., news, governmental publication, Journals, public opinion experts, and reports received by the concerned regulatory authorities. |
| 9 | Forming and activating a crisis management team called the construction projects crisis management team, once receiving a notification of an approaching crisis, whether through internal and external oversight before crisis. | 9.1 Define names of experts or their substitutes, job titles, and appropriate channels of communication, in addition to defining the roles and responsibilities of each member of the team.<br>9.2 Forming and activation a competitive team includes a variety of experts and project managers or their representatives in the departments of sectors, contracts, law, administration and finance, investment, and others as required. |
| 10 | Provide the necessary organization and administrative coordination to deal with the crisis. | 10.1 Create a structural chart that supports coordination and response between the various departments of the organization and the proper authorities.<br>10.2 Include a chart in the crisis management plan that shows the final authority and who delivers his reports to whom. |
| 11 | The team developed and analyzed the expected scenarios of the crisis and researched the possible risks and impacts on the construction projects using the latest predictive methods. | 11.1 Holding workshops with the participation of stakeholders and expert project managers in which imagination, lateral thinking, comparison, and review of past experiences are used in :<br>1. Generating or developing at least three scenarios that take into account (the worst, moderate, and best scenario).<br>2. Drawing a mental map for identifying the most important risks that the crisis may cause and pose a potential threat to the continued implementation of construction projects.<br>3. Estimation of its potential effects on cost, time, and quality of projects.<br>4. Providing appropriate alternative preventive plans for the most important expected risks and scenarios provided in workshops. |
| **Crisis plans library** | | |
| 12 | Establishing a library or system in which crisis plans that were prepared by the crisis management team before the crisis is stored. | 12.1 Establishing a permanent library or system to document crisis plans in an accessible manner by the implementing parties of the plan.<br>12.2 Studying and documenting successful experiences and the expertise of developed countries in facing crises and benefiting from them.<br>12.3 Including plans that were previously |

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| | | created or used in dealing with previous crises and plans that fit the current crisis conditions facing construction projects.<br>12.4 Dividing plans within the system according to their types, stages (before, during, after), the resulting or possible scenarios for the chosen type of crisis, and developing the appropriate treatments for each expected scenario. |

**Table 3.** Proposed procedures for during crisis stage.

| **The emergency meeting of construction projects crisis management team** | | |
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| No | Sub criteria | Proposed procedures/guideline |
| 13 | Holding an emergency meeting of the construction projects crisis management team, whose members were previously selected before the crisis, where during the meeting, the most appropriate plan is selected from among the plans previously prepared before the crisis. | 13.1 Hold an emergency meeting in which the current situation and crisis developments are discussed and perusing the crisis cases library or system to compare the extent of congruence in the conditions of previous crises with the current situation.<br>13.2 Review the crisis plans system to take advantage of the most important plans formulated in advance before the crisis or ones that already exist in it.<br>13.3 Evaluate alternative plans or decisions that were formulated before the crisis to choose the most appropriate ones according to the developments of the crisis and according to the criteria of their financial, economic, legal or administrative feasibility.<br>13.4 Submitting recommendations for the proposed plan to the decision-makers in the concerned authorities for approval as soon as possible.<br>13.5 Manually intervention by the experts of the crisis management team to introduce the required and appropriate modifications to the plan, then evaluate and recommend it as well, in the event that there were plans. Still, they do not match or are commensurate with the situation of the crisis. |
| **Implementation of the approved plan** | | |
| 14 | Formulating, activating, and implementing an effective system and strategies to communicate with the various stakeholders that need to reach during the crisis. | 14.1 Determining the job titles of the key stakeholders to be communicated with.<br>14.2 Determine when to communicate according to crisis levels.<br>14.3 Establishing the appropriate mechanism for communication.<br>14.4 Identifying the appropriate communication |

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| | | tools for each party.<br>14.5 Determine the information to be communicated. |
| 15 | Conducting the necessary training on the approved crisis management plan to allow for possible improvements in a timely manner with a focus on the efficiency and effectiveness of the plan. | 15.1 Holding meetings, workshops, or conferences that include all stakeholders [The contracting parties and executing companies] implementing the plan for :<br>1. Inform them and explain the terms of the plan in full.<br>2. Clarify the roles and responsibilities of each party.<br>3. Evaluate the procedures documented in the plan and determine what can be modified or added.<br>4. Identifying the weak parties or members and replacing them to avoid reluctance to work. |
| 16 | Creating a crisis checklist, such as a record or system that is used to document all the procedures that have taken place and are specific to each crisis. | 16.1 Maintain a reliable and accurate record of all planning sessions, meetings, or workshops.<br>16.2 Recording all decisions made by the team.<br>16.3 Recording thoughts, feelings, and reasons for deciding on a recording device.<br>16.4 Recording the time, date, and person who made the decision.<br>16.5 Continuously update the record. |
| 17 | Ensure the correct and accurate plan implementation through continuous follow-up of the contracting parties and companies executing the plan. | 17.1 Emphasis on integrity and transparency in implementing decisions issued or plans by all implementing parties.<br>17.2 Forming committees whose task is to monitor the correct implementation of the plan, point out deviations from the plan, and take corrective actions. |

**Table 4.** Proposed procedures for post crisis stage.

| **Evaluation of crisis management plan** | | |
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| No | Sub criteria | Proposed procedures/guideline |
| 18 | Establishing an independent investigation system by the institution itself or a third party to research the causes of the crisis and the weaknesses and strengths of the crisis response efforts. | 18.1 Unbiased identification of the economic, political, social, cultural factors causing and motivating the crisis.<br>18.2 Determine the most important factors that contributed to the exacerbation of the crisis on construction projects.<br>18.3 Identify construction companies that have taken the most important actions.<br>18.4 Reviewing potential deficiencies and weaknesses in the efforts to respond to the crisis, whether by decision-makers or the authorities |

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| | | implementing the decisions/plans.<br>18.5 Identifying those affected by the crisis: diagnose projects, sectors, or stakeholders affected by the crisis. |
| **Recovery after the crisis** | | |
| 19 | Addressing potential shortcomings in the efforts to respond to the crisis by all the defaulting parties during the crisis. | Suggestions at the macro level:<br>19.1 Suggesting treatments for the most important factors causing crisis in Iraq.<br>Suggestions at the micro-level:<br>19.2 Suggesting treatments for the most important factors that had the greatest negative impact in the aggravation of crisis on the construction projects in Iraq.<br>19.3 Suggesting operational actions for contracting companies in times of crisis in general, or a structural for self-financing general contracting companies in particular.<br>19.4 Suggesting treatments for addressing the weaknesses related to the efforts to respond to the crisis, whether by decision-makers the authorities are implementing the decisions/plans.<br>19.5 Resume the implementation of projects according to a systematic plan prepared for that and according to priority.<br>19.6 Securing the funding sources necessary for the implementation of the resumption and reconstruction plan for the suspended projects. |
| **Learning from crisis** | | |
| 20 | Develop an effective mechanism for learning from crises. | 20.1 Develop a learning mechanism that allows embodying, summarizing, and documenting the lessons learned from the crisis.<br>20.2 Identify the most important response measures that have gone well, that should be maintained and improved, or that may be useful in the future.<br>20.3 Establishing a database that includes all the decisions taken regarding the treatment of investment projects during the crisis.<br>20.4 Documenting the realistic effects of the crisis on the construction projects and using them to create pictures and approximate scenarios in similar crises in the future. |

## 5. CONCLUSIONS

The index of the relative importance of the critical success factors contributing to the development of the proposed crisis management system ranged from (0.746) to (0.924), which indicates the great importance of these criteria in helping to improve the preparedness of the Iraqi construction sector in dealing with crises.

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