An Analytical Study to Evaluate Iraqi Construction Sector Readiness to Manage Post-Disaster Reconstruction

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Abstract. The research aims to conduct an analytical study for Iraqi construction sector to examine the extent of readiness to implement campaigns for post-disaster reconstruction, especially after war disasters. Wars cause massive disasters and great devastation for all sectors, especially to the construction sector. Post-disaster reconstruction after wars become a critical topic for many countries, especially developing ones. The Iraqi construction sector witnessed great destruction in large parts of it due to the last wars in 2014, which resulted in the destruction of many areas and a significant deterioration in infrastructure. Through literary reviews of studies related to the research topic, the researcher will determine the critical success factors for disaster management and devise measures to be taken to be suitable for their application in the reconstruction of the Iraqi construction sector. various terms such as risk management, Stakeholder Management and supply chain management were investigated. In addition to exploring various aspects of disaster management to better understand it, for example, the classification of disasters and the stages of disaster management. Project management principles are discovered for the commitments of this research as well as opinions of experts working in Iraqi construction sector to investigate the suitable action plans for post disaster reconstruction management system. The consequences of this research are used to provide a better understanding of reconstruction mechanisms as well as a comprehensive assessment of the readiness of the Iraqi construction sector.

1. Introduction

Disasters are one of the important events that the construction projects are exposed to during the construction period. The impact of disasters is increasing on the projects constructed because they lead to massive damage to infrastructure, resulting in a huge loss of money and lives. These losses cause enormous economic damage affecting the economy of countries, especially developing ones (Kerzner, 2011). The country generally seeks to define standard measures for disaster response by defining the processes and policies that must be followed for the post-disaster recovery phase to implement the reconstruction. The severity of the disasters and their environmental, economic and social impacts vary according to the type, size and cause of the disaster. Therefore, the reconstruction plan must be flexible enough to fit the situation variables (PMI, 2007). This paper discovers the background of disaster reconstruction, whereas it studies present critical success factors, procedures and practices, which can be exploited by decision makers for post disaster reconstruction management model. Through previous
studies and literary topics related to the research subject, in addition to expert opinions in the field of Iraqi construction, 282 critical success factors have been identified that must be met in the reconstruction plan. The questionnaire was prepared to determine the degree of importance of factors through the use of five-point Likert scale. Only 31 criteria out of a total of 282 critical success factors with a degree of relative importance higher than 80% that can be relied upon when managing the reconstruction operations after disasters.

2. Disaster Management
The term disasters denote enormous changes in the normal activities of societies, with a significant negative impact on their property and work, and as a final result of natural or man-made disasters (Carroll, 2001). The stages of disaster recovery are either short-term, which deals with life activities related to the daily life of those affected, or they are long-term related to post-disaster reconstruction campaigns. (Baroudi, 2012). Events related to disaster recovery operations are called a recovery plan or emergency plan. The recovery plan is characterized by many advantages such as the availability of a safety plan, damage assessment, detection and assessment of risks, good planning of resources for the reconstruction plan, among others. The impact of disasters can be analyzed in two phases: the first is pre-disaster and the second is post-disaster. The pre-disaster plan examines how to integrate the means necessary for detection and preparation for disaster response and safety measures taken. While the post-disaster plan examines the measures that must be taken to address the effects of disasters and ways to rebuild projects and start reconstruction campaigns while minimizing the damage caused by the disaster. (Helsloot, 2004).

3. Classification of Disasters
Disasters are classified by disaster management specialists into several categories, and they can be classified according to the speed of their occurrence into rapid or sudden disasters and slow disasters. It is also classified by others according to the cause of their occurrence into natural or man-made disasters. Some researchers may add another type of classification which is hybrid disaster. (Biswas & Choudhuri, 2012). Natural disasters are disasters that occur as a result of natural causes such as volcanoes, earthquakes, etc., that is, caused by natural forces and not by humans. As for man-made disasters, they are the result of events that mainly involve humans, such as wars and conflicts. For example, this type leads to severe damage, especially in the social and economic aspect of societies, and leads to great losses in services and infrastructure. (Pelling et al., 2004). Hybrid disasters are the result of human errors and natural forces at the same time. For example, the extensive damage caused by floods and its effects are increased due to construction on fragile lands vulnerable to floods. Likewise, earthquake exposure and its effects are exacerbated by failure to take necessary safety measures and earthquake-resistant building standards (Shaluf, 2007). Table (1) shows the differences and similarities between natural and man-made disasters. Hybrid disasters are disasters whose effects can be reduced or avoided when following specific procedures and rules, and may appear in developing countries more because of lack of safety procedures and rule. (Researcher)

| Table 1. Differences and similarities between natural and man-made disasters (Researcher). |
|-----------------------------------------------|-----------------------------------------------|
| **Man-Made Disaster**                        | **Natural Disaster**                          |
| Differences                                   |                                               |
| 1. results directly from human activity       | event caused by natural forces                |
| 2. can be prevented                            | cannot be prevented                           |
| 3. occurs at unanticipated localities         | occurs at unexpected localities              |
| 4. cannot prepare for it                      | can prepare for it                            |
| 5. The occurrence and duration of a Man-made disaster cannot be calculated | The occurrence and duration of a natural disaster can be calculated |
Similarities

1. Both cause massive losses
2. Both cause Mental effects: biochemical contamination, damage of assets or resources, health influences
3. Both cause Social impacts: psychosocial symptoms, socioeconomic loss, sociodemographic loss, political disturbance
4. Both have greater implications for developing countries than for developed ones
5. Both should be given the highest priority as soon as they happen

4. Project Management Success Factor for Post Disaster Reconstruction Plan

When managing disaster, it is very important for all parties involved in the reconstruction process to identify and understand the critical success factors affecting disaster management. (Karunasena and Rameezdeen, 2010). A few studies were conducted in post-disaster reconstruction with a focus on critical success factors where a number of factors were identified and are as follows: integrated institutional structure, coordination between stakeholders, the presence of systems and laws, professional competence, commitment to goals and frameworks Time management, effective logistics management, plus resource allocation (Ophiyandri, 2013). The active participation of societies is a key factor for success in the post-disaster rebuilding plan. Among the critical success factors (CSFs) that affected the post-disaster rebuilding plan are: political criteria, the existence of an appropriate reconstruction strategy, good communication between project parties, government support, community trust in their governments as well as the most important factor is providing the necessary financing. (Pardede, 2012).

The researcher visited a number of state departments and government institutions to discuss the importance of the topic and to know the most important axes to be studied and which experts believe have an important role in disaster management, but it has not been studied sufficiently, and when the researcher reviewed the literature and previous studies, he found a great lack of local studies that are looking at managing Disasters, specifically in the following axes, which were chosen to determine the degree of their importance and the readiness of the Iraqi construction sector to implement them, namely: risk management, Stakeholders’ management and supply chain management through identify the critical success factors in order to develop a suitable disaster management system for Iraqi construction sector. (Researcher)

5. Field work

The practical aspect of the research includes three main axes: The first axis: the personal data of the respondents. The second axis: Questions to test the readiness of the Iraqi construction sector to manage post-disaster reconstruction operations. The third axis: determining the degree of importance of the critical success factors.

5.1. Questionnaire structure

The tool of this survey is using the form of closed questionnaire distributed to the engineers working in both public and private sectors of various domains to find out the evaluation of the CSF. The researcher adopted in the preparation of questionnaire paragraphs on the literature reviews, International Organization for Standardization (ISO) 22301 and 27001 for disaster reconstruction plan as well as the expert interviews to prepare the form. The targeted sample should be able to satisfy the objectives of the study; therefore, the researcher distributed (110) questionnaire forms to various destinations concerned with construction projects, 82 forms were answered only which indicates that the response rate as 75 %, which is high and good. Research sample consists of general directors, engineers working in ministries of government and infrastructure projects and experts who evaluate suitable style to accomplish infrastructure projects, also engineers in private sector and UN organizations such as UNDP, UNICEF.
The questionnaire was developed by using, as much as possible; simple and understandable terms to the engineers.

5.2. Statistical Analysis of the Questionnaire Paragraphs
This part includes the statistical analysis of the questionnaire. The researcher used SPSS to analyse the collected data and to generate the figures that provide better understand.

5.2.1. Analysis of Personal Information
1- best identification of samples
Figure (1) shows best identification of samples that 48% of respondents working as an engineer, while 11% are working as Consultant, and the same ratio as a legal insinuation, while 10% are economic and financial, 7% are working as Managerial and administration and 13% as Contractor.

![Figure 1. Best identification of the sample.](image1)

2- years of experience
Figure (2) shows the number of years of experience for the research sample members, most of them have no less than five years of practical experience. It is seen from the figure below that the most of respondents have high experience, and this supports the findings of this study and the sincerity of the questionnaire.

![Figure 2. years of experience of the sample.](image2)

3- Education qualification
From questionnaire results, it is observed that the proportion of respondents who have a bachelor's degree is (45%), while the proportion of respondents they have master's degree is (35%), and finally the percentage of respondents who have a doctorate degree by (20%), as shown in Figure (3).
The percentage of engineers from the total research sample is 59%. It is observed that the engineering disciplines were distributed by 43% to civil engineers, 10% to architect engineers, then 26% to mechanical engineers, while environmental engineers at 6% and 11% to the electrical engineers, and a percentage of 4% to other specialty, as shown in figure (4).

5- **Working Sector**

Figure (5) shows the workplace of sample members, which 58% of respondents work in public sector, while 10% are working in the private sector, and 20 % are working in both sector, while 12% are working in an NGO, respondents illustrated by the following figure:
5.2.2. Analysis of the evaluation of disaster management in the Iraqi construction sector

The importance of this axis of the questionnaire is represented by providing a comprehensive perception of the Iraqi construction sector's readiness to implement reconstruction campaigns. This part of the questionnaire enables to identify gaps that may slow down disaster management processes. This axis included the following questions:

1- Does your company / institution have guidance to differentiate between reconstruction in traditional circumstances and in disaster circumstances?

From figure (6), a large percentage of the bodies responsible for reconstruction show do not have a specific guidance for implementing campaigns for reconstruction in disaster situations, while only 9% have guidance for distinguishing between regular reconstruction from emergency situations, and the survey showed that 11% of Respondents are unsure of such guidance.

2- Are there new legislations for referral mechanisms for post-disaster reconstruction projects?

From Figure (7), it turns out that 67% of the agencies responsible for reconstruction have not issued new legislation related to project referral, they do not have specific evidence to implement reconstruction campaigns in disaster situations, while only 7% are sure that they have legislation related
to project referral in Cases after disasters. The survey indicated that 26% of respondents are not sure of the existence of legislation related to post-disaster reconstruction.

![Figure 7. having a new legislation for referral mechanisms for post-disaster reconstruction projects.](image)

3- Is your institution contributing in post disaster reconstruction plan through official partnerships and relationships at regional or national levels?

The survey indicated that half of the respondents indicated that the agencies working in them do not have formal partnerships with local or international bodies in the matter of post-disaster reconstruction, while 37% indicated that they have partnerships or cooperation in this field with 13% of the respondents were not sure of the existence of partnerships. Although the Iraqi Ministry of Planning developed a methodology for the reconstruction of Iraq after the disasters of the war it was exposed to, but many not a few percent of respondents are unaware of the existence of a reconstruction plan or they are not sure of its existence, which indicates a clear weakness in the group work organization and stakeholder consultation. In the planning stage. (Researcher)

![Figure 8. contribution in post disaster reconstruction plan through official partnerships.](image)

4- Does your organization consider the environmental considerations resulting from disasters in the reconstruction projects?

From the figure below, we note that 47% did not take into account the environmental aspects when planning reconstruction projects after disasters, while only 25% took into account the environmental impacts when planning reconstruction projects, with a 28% not sure about the implementation of environmental considerations.
5- In your opinion, what is the degree of importance of each stage of Iraqi post disaster reconstruction plan?

The important stage of disaster management stages according to the opinion of the research sample is the financing stage followed by the planning and risk assessment stage and then the resource allocation stage, while the least important stage according to the opinion of the research sample is the operation and maintenance stage as shown in figure (10).

5.2.3. analysis of CSFs affected post disaster reconstruction system

Through previous studies related to disaster management and expert opinion, 282 critical success factors affecting disaster management in the Iraqi construction sector were identified. A questionnaire was developed and the respondents requested to rank these criteria for implementing of post disaster reconstruction projects according to a five-point Likert scale which is the extensively used approach in survey investigation, in Likert scale the (1 = Least Important and 5 = Most Important). The analysis of obtained data was done by using the Relative Importance Index (RII) method as in equation 1.

\[ RII = \frac{\sum_{i=1}^{n}(X1 \times S1 + X2 \times S2 + \ldots + Xn \times Sn)}{(A \times N)} \]

Where:
- \( RII \) = the Relative Importance Index
- \( S \) = weights of each factor
- \( X \) = frequency of each rating
- \( N \) = total number of responses
A = highest weight (i.e. 5 in this case)

5.3. The ANP model

The ANP model aims to measure all interrelations inside the ANP model quantitatively, after building the system model, a pairwise comparison questionnaire, in place of the relative impact of affecting clusters and nodes on the affected node for all possible pairs, and by computed geometrical means for all the comparative provisions associated with each question to discover the aggregated set judgments, then, utilize the assess/compare module of the Super Decisions software. Then obtained the priorities derived from paired comparison matrices using the software Super Decisions, Automatically, the software calculated the eigenvector of priorities (the impact of each component on the other one) and the consistency ratio (CR). The relative importance of elements (or components) being compared by solving the following formulae (Nurgül, 2014). The main purpose of the researcher’s use of the network analysis technique is to arrange the factors according to their weights as shown in the table 2.

Table 2. The critical success factors and the required action plan.

| criteria | Proposed action plan (proposed procedure) |
|----------|------------------------------------------|
| 1        | Integrity in all aspects of the disaster reconstruction plan. | 1.1 Identify the scope of PDRMS. 1.2 A full understanding of the importance of reconstruction and its important role in the recovery process afterwards. |
| 2        | Legislation framework designed appropriately for the post-disaster reconstruction plan. | 2.1 Rapid interaction from local governments to form a body dedicated to the reconstruction campaign. 2.2 The formation of this body of experts or specialists from all parties involved in the reconstruction campaign. 2.3 Review existing laws related to reconstruction and study their suitability for the current situation in the Iraqi construction sector. |
| 3        | Create a comprehensive awareness of the importance of disaster management for the success of the reconstruction process. | 3.1 Clarify the scale of the damage and the numbers of those affected. 3.2 Using the experiences of previous countries in reconstruction. 3.3 Sharing ideas with all concerned disaster management. |
| 4        | Stability and lack of government changes. | 4.1 In most countries, it is not possible to control the stability of the country or reduce political fluctuations, but some preventive measures can be taken, including: 4.2 Involving governments and decision-makers in the reconstruction campaign. 4.3 Long-term plans that take into account changes in policies. 4.4 Study the effect of political fluctuations and the constant change in the system of government and its impact on post-disaster reconstruction. |
| 5        | Evaluate potential risks throughout the entire life of the project. | 5.1 A description of the asset 5.2 Date of installation 5.3 Expected useful life 5.4 Asset value |
| 6        | Study the risks that supply chains may be exposed to in post-disaster reconstruction. | 6.1 Study the reality of supply chains in the Iraqi construction sector. 6.2 Gaps analysis in supply chains |
6.3 Develop alternative plans to ensure continuity of supply chains for the reconstruction process.

7.1 Legal feasibility
7.2 Technical
7.3 social/environment safeguards analysis

8.1 Institutional capability analysis
8.2 Identification of next steps required

9.1 Provide lists of names of specialists in the field of post-disaster reconstruction, from local or international experiences.
9.2 Create appropriate mechanisms for work and benefit from experiences.
9.3 Resorting to partnership contracts with the private sector and involving it in the reconstruction process.

10.1 Preparation of venture team and authority structure.
10.2 Involve a team of consultants.

11.1 Set up the project team and government structure.
11.2 Engage a team of advisers
11.3 Develop a plan and timetable for project preparation and procurement

12.1 Scoping to identify the full range of probable social and environmental risks.
12.2 Describe relevant physical, biological and socioeconomic risks.
12.3 Examine the effects that disasters may cause on PDRMS.

13.1 Develop an effective public plan to involve all potentially affected members of the public.
13.2 Study possible alternatives for consideration of a PDRMS.
13.3 Study the environmental and social impacts that may be caused.

14.1 Develop outline as well as schedule of preparation and procurement of the project.
15.1Benefit from the analysis and identification of stakeholders.
15.2Involve major beneficiaries of reconstruction in the preparation stages.

16.1 Collecting and analyzing previous studies such as risk analysis, determining demand, knowledge of stakeholders, experts.
16.2 Determine priorities to start PDRMS.
17.1 Identify gaps in local capacities.
17.2 The use of experts to train and qualify the local cadres.
17.3 Training in modern techniques used in the reconstruction.

18 Focus on the non-oil sectors to create new development opportunities

18.1 The use of experts to study the economic side.  
18.2 Analysis of non-oil investment opportunities.
18.3 Reviving and supporting the agricultural, industrial and commercial sectors to create new financing opportunities.
18.4 Benefiting from the successful experiences of developing countries

19 Hiring experts to develop the economic side.

19.1 Provide appropriate customization for them.  
19.2 Determine the aspects that need expert provision

20 Resorting to partnership contracts as an alternative to traditional contracting mechanisms.

20.1 Studying the partnership contracts as an alternative to the traditional contracts in the reconstruction phase.
20.2 Using successful experiences of developing countries in implementing partnership contracts for reconstruction projects.

21 Activating the role of effective administrative control.

21.1 Forming the appropriate administrative committees to take decisions.
21.2 Focus on the role of legislation to define roles and responsibilities.

22 Provide appropriate alternatives by developing plans and preventive measures for the expected risks.

22.1 Focus on developing alternative plans.  
22.2 Focus on taking preventive measures
22.3 Focus on preparing corrective actions

23 Risks and opportunities analysis.

23.1 Potential risk analysis  
23.2 Providing alternative solutions
23.3 Study alternative solutions to choose the best among the alternatives

24 Political remediation to promote decentralization and the ability to implement the reconstruction plan.

24.1 Governments embrace the reconstruction.  
24.2 Continuous monitoring to measure the volume of work performed and its conformity with standards.
24.3 Review legislation and laws and ensure their suitability for the current situation.
24.4 Activating the role of regulatory institutions.

25 Ensure that projects are executed efficiently while observing safety procedures / standards.

25.1 Define the required safety standards during the reconstruction process.
25.2 Forming committees from the institutions concerned with the reconstruction, responsible for following up the implementation of the projects with the required specifications.
25.3 Define deviations in the reconstruction plans  
   Take corrective action.

26 Setting Plan to optimize the benefit of reconstruction budget.

26.1 Determine the sources of funding.  
26.2 Create timelines.
26.3 Monitor the disbursement of funding according to the set timetables.
26.4 Continuous monitoring and evaluation plans for reconstruction.
|   | Follow-up and continuous training for stakeholders to keep abreast of the latest technologies in disaster management. |
|---|--------------------------------------------------------------------------------------------------|
| 27 | 27.1 Identify gaps to develop stakeholder capacity building.                                      |
|   | 27.2 Identify appropriate training programs.                                                     |
|   | 27.3 Monitor aspects of funding disbursement for training.                                       |
|   | 27.4 Follow-up to the effectiveness of training plans and their impact on reconstruction.        |
|   | 28.1 Follow up the performance of local human resources.                                         |
| 28 | 28.2 Continued monitoring and evaluation.                                                        |
|   | 28.3 Take corrective action.                                                                     |
|   | Using the local workforce in the reconstruction process.                                         |
|   | 29.1 Locating local suppliers.                                                                   |
|   | 29.2 Create an information network that includes the names and addresses of suppliers.          |
|   | 29.3 Determine the quantities of materials available on the market.                              |
| 29 | There are strategy and policy to coordinate the operations of materials supplying can be developed into an integrated system for the supply chain management. |
|   | 30.1 Determine who is responsible for providing information.                                     |
|   | 30.2 Ensure that the information received is correct and accurate.                               |
|   | 30.3 Constant update of network information.                                                     |
|   | 30.4 Identify the beneficiaries of the information network.                                      |
|   | 30.5 Control the security of data and information within the network.                            |
|   | 30.6 Publishing and circulating periodicals and publications continuously to the beneficiaries of the information network. |
| 30 | Establish a reliable network for exchanging information.                                          |
|   | 31.1 Determine the sources of supply of materials.                                                |
|   | 31.2 Ensure that it complies with the required specifications and quality standards.             |
|   | 31.3 Ensure that the required quantities are available and according to the requirements of the reconstruction phase. |
|   | Determine the types and specifications of the quantities of construction materials.               |

### 6. Conclusion

The results of this research benefit decision makers from consultants and engineers. They also provide a precise and clear understanding of the requirements of the Iraq reconstruction plan by finding weights of critical success factors. Through the results of the questionnaire, the researcher found the following conclusions:

1- Although Iraqi ministry of planning developed a methodology for the reconstruction of Iraq after the disasters of the war it was exposed to, but high percent of respondents are unaware of the existence of a reconstruction plan or they are not sure of its existence, which indicates a clear weakness in the group work organization and stakeholder consultation in the planning stage.

2- A large percentage of the bodies responsible for reconstruction show do not have a specific guidance for implementing campaigns for reconstruction in disaster situations, while only 9% have guidance for distinguishing between regular reconstruction from emergency situations, and the survey showed that 11% of respondents are unsure of such guidance.

3- A wide range reaches to 67% of the agencies responsible for reconstruction have not issued new legislation related to project referral, they do not have specific evidence to implement
reconstruction campaigns in disaster situations, while only 7% are sure that they have legislation related to project referral in cases after disasters. The survey indicated that 26% of respondents are not sure of the existence of legislation related to post-disaster reconstruction.

4- The respondents indicated that the agencies working in them do not have formal partnerships with local or international bodies in the matter of post-disaster reconstruction, while 37% indicated that they have partnerships or cooperation in this field with 13% of the respondents were not sure of the existence of partnerships.

5- The result shows 47% of Iraqi companies did not take into account the environmental aspects when planning reconstruction projects after disasters, while only 25% took into account the environmental impacts when planning reconstruction projects, with a 28% not sure about the implementation of environmental considerations.

6- From the result gained, the respondents indicated that the important stage of disaster management stages according to the opinion of the research sample is the financing stage followed by the planning and risk assessment stage and then the resource allocation stage, while the least important stage according to the opinion of the research sample is the operation and maintenance stage.

7- Despite the presence of many critical success factors, the factors with a higher degree of impact were limited according to the opinions of the respondents, as the researcher found only 31 criteria out of a total of 282 critical success factors with a degree of relative importance higher than 80% that can be relied upon when managing the reconstruction operations after disasters.

8- The factor that have the highest weight according ANP technique is the integrity in all aspects of the disaster reconstruction plan. Which confirms the importance of this research to develop the Iraqi construction sector and fill the gaps that have been revealed by assessing its readiness for disaster management.

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