Evaluation of the reasons of delay for construction projects under terrorism risk

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Abstract: One of the most common issues in the construction industry is the delay problem. The majority of the researchers have been focused to study the delay reasons in the implementation phase while few of them adopted to discuss the delay reasons for the early phases for the project planning and design phases. Therefore, this paper aims to study the reasons of the project delay in the planning and design phases as well as the implementation phase during the period of terrorism. A questionnaire included the delay reasons for the three phases that have been sent to the questioners of engineers who are working in the public and private Iraqi construction industry. The valid responses have been tested using Chi-Square Test to indicate the validity and reliability of the results and the relative importance index (RII) to show the average repetition of delay happening. The results showed that the main direct reason causes a delay in the planning phase is the unavailability of the fundamental data for the. Whereas, projects the design phase the analysis of the questionnaire results specified the owner's financial issues was the significant delay reason. Moreover, the most effective delay's reason in the implementation phase is the terrorist acts and cut off roads.

1. Introduction
Delay of the construction project can be defined as the difference between the contract finish date and the actual date of the construction project completion that leads to economic and social impacts [1]. In the Iraqi construction industry as well as many countries in the world, the majority of the construction project needs to extend the contract implementation period and extra time produces negative social and economic impacts. Therefore, many researchers in Iraq and other countries have been studied these phenomena to mitigate the negative effects of it and give the contractors and the owners suitable recommendations to reduce the delay risks. For instance, a study has been done investigating the key factors caused the overrun time for six Iraqi construction projects, the interviews and the questionnaire survey adopted to identify forty-eight delay factors [2]. Moreover, the most significant reasons cause a delay in public projects in Iraq has been examined by Ghanim A. Baker research which was achieved through an intensive literature review and a survey [3].as well as, 58 causes of delay identified by a study to assess the delay of the
construction projects in Baghdad city, Iraq, the study followed through a field survey of a questionnaire [4] and conference paper investigated the factors that cause delays in highway construction projects in Iraq[5]. For other countries, Saudi studied the causes of delays in Saudi public construction projects [6] as well as research discussed the delay in Ghanaian construction project with questionnaire survey include Thirty-two possible causes of delay in addition to many research papers all over the world. The delay reasons in the project can be classified into classes related to the responsibility of direct and indirect delay reasons [7]. The direct reasons come from the failure in project management by the project crew and the second type comes from out of the control of the project working team [8]. This paper is going to give an idea about the most effective causes that can make the project out of the contract date completion during the planning, design and implementation phases.

2. Methodology

2.1 Data collection

In this paper, the delay reasons have been collected from the literature and the fundamental data of completed projects by the researcher from the construction industry institutions. The concluded reasons have been present to the experts of the construction industry in personal interviews to review the questionnaire reasons during the period (January 2014 to December 2015). A questionnaire included the delay reasons for the three phases that have been prepared and sent to the engineers who are working in different Iraqi organizations specialise in the construction industry.

2.2 Data validation and analysis

The questionnaires collected responses have to validate using one of the testing methods to indicate the honesty and stability of the questionnaires and the percentages to study the recurrence in the occurrence of various delay causes for all phases. The Chi-Square test has been involved to show the moral significance for the delay reasons in the different phases as well as to investigate the importance of the working experience period of the questioners. The formula for Chi-Square Test is

\[ X^2 = \sum_{i=1}^{n} \frac{(O_i - E_i)^2}{E_i} \]  

(1)

Where:

- \( X^2 \) = degree of freedom
- \( O \) = observed value(s)
- \( E \) = Expected Value(s) [9]

As well as, in this study the Relative Importance Index (RII) has been adopted to indicate the average repetition of delay happening by using the formula below:

\[ RII = \sum_{W=1}^{N} \frac{W}{A N} \times 100 \]  

(2)

\[ RII = \frac{3n_3 + 2n_2 + 1n_1}{3 X N} \]  

(3)

\( 0 \leq RII \leq 1 \) [10]

Where: \( W \): is the weight given to each items by the respondents, range from 1 to 3; such 1 the least implying (Strongly Disagree) and 3 the highest implying (Strongly Agree).

\( A \): is the highest weight (3 in 3-point Likert scale)

\( N \): is the total number of the respondents.

Whereas the limitation of RII has been classified as it shown in Table (1)
Table 1. The limitation that has been proposed to classify Relative Importance Index value:

| RII values | Importance level |
|-----------|-----------------|
| 0.66 ≤ RII ≤ 1 | High (H)        |
| 0.33 ≤ RII ≤ 0.66 | Medium (M)     |
| 0 ≤ RII ≤ 0.33 | Low (L)         |

The questioners have been classified according to the period of working experiences as it is shown in Tables 2-4.

Table 2. The number and the Chi Square ($\chi^2$) depend on the working experiences time for questioners during planning phase.

| N | Experiences (Years) | Number of questioners | Percentage (%) |
|---|---------------------|-----------------------|----------------|
| 1 | Less than 5         | 15                    | 20.83 %        |
| 2 | 6-10                | 18                    | 25 %           |
| 3 | 11-15               | 21                    | 29.17 %        |
| 4 | 16-20               | 13                    | 18.06 %        |
| 5 | More than 20        | 5                     | 6.94 %         |
|   | Total               | 72                    | 100 %          |

Chi Square Value ($\chi^2$) **7.82 (**$P<0.01$)

It is clear from Table (2) which includes the percentages according to years of experience in the field of engineering works in the planning stage that the value of the Chi-square has reached 7.82 which is greater than the value of the scheduled $X^2$ of 4.07 which is a value of significant significance level (0.01). It indicates that the years of experience of the research sample were very good and reflect the homogeneity between the groups represented in the table, as it reached the highest percentage of 29.17% for the age group of (11-15) years, while the other percentages mentioned in the table reached (20.83%, 25.00%, 18.06%, 6.74%).

Table 3. The number and the Chi Square ($\chi^2$) depend on the working experiences time for questioners during design phase.

| N | Experiences (Years) | Number of questioners | Percentage (%) |
|---|---------------------|-----------------------|----------------|
| 1 | Less than 5         | 19                    | 29.69 %        |
| 2 | 6-10                | 14                    | 21.88 %        |
| 3 | 11-15               | 17                    | 26.56 %        |
| 4 | 16-20               | 7                     | 10.94 %        |
| 5 | More than 20        | 7                     | 10.94 %        |
|   | Total               | 64                    | 100 %          |

Chi Square Value ($\chi^2$) **6.89 (**$P<0.01$)

As it indicated in Table (3), which includes percentages according to years of experience in the field of engineering work in the design phase, it was clarified that the value of the Chi-square has reached 6.89, which is greater than the value of the scheduled $X^2$ of 4.07, which is the value Significant with a level of (0.01) and this indicates that the years of experience of the research sample were very good and reflect the homogeneity between the groups represented in the table, as the highest percentage reached 29.69% for the age group of (less than 5 years), while the other percentages mentioned in the table reached (21.88 %, 26.56%, 10.94%, 10.94%).
Table 4. The number and the Chi Square ($\chi^2$) depend on the working experiences time for questioners during implementation phase.

| N  | Experiences (Years) | Number of questioners | Percentage (%) |
|----|---------------------|-----------------------|----------------|
| 1  | Less than 5         | 17                    | 24.29 %        |
| 2  | 6-10                | 10                    | 14.29 %        |
| 3  | 11-15               | 12                    | 17.14 %        |
| 4  | 16-20               | 12                    | 17.14 %        |
| 5  | More than 20        | 19                    | 27.14 %        |
|    | Total               | 70                    | 100 %          |

Chi Square Value ($\chi^2$) **5.62 (**$P<0.01$)**

Table (4) includes the percentages according to years of experience in the field of engineering work in the implementation axis, in which it was clarified that the value of the Chi-square has reached 5.62, which is greater than the value of the scheduled $X^2$ of 4.07, which is a value of significant significance level (0.01). This indicates that the years of experience of the research sample were very good and reflect the homogeneity between the groups represented in the table, as the highest percentage reached 27.14% for the age group of (more than 20 years), while the other percentages mentioned in the table reached (24.29%, 14.29%, 17.14%, 17.14%).

Finally, the triple scale (1, 2, 3) has been implemented to discover the ranking of the delay reasons. The research assumes the number of responses for (A lot) multiply by 3, for (Average) multiply by 2 and the choices for (less) multiply by 1 to get the total scores for every reason in each phase and category. Then the total scores for every table have been ranked descending ranking and the highest total scores should be the most effective reasons.

3. Result and discussion

Three phases of the construction project proposed to investigate in this research, the planning phase, design phase, the implementation phase. Table (5) presents the classification of the concluded reasons numbers for each phase of the project.

Table 5. the number of reasons for each proposed phase of the project.

| Phases of the project | No. of reasons |
|-----------------------|----------------|
| Planning Phase        | 15             |
| Design Phase          | 19             |
| Implementation Phase  | 76             |

3.1 Planning Phase

As indicated in Table (6) and regarding the result of the Chi-square analysis of the reasons for the delay in the planning phase (delay due to the property disputes on the project land) comes first, as the value of Chi-square $X^2$ has reached 8.63, while the reason of delay (The duration of the contract is unclear) and the value of $X^2$ has 8.19 in the second rank, which are greater than the scheduled value in $X^2$ table of 4.07 since they are two values of significant indication at the level of (0.01) as well as five other values came in value in the table was for the reasons for the direct delay of this phase is for a reason (the initial planning is the same level of moral significance. while the other the four reasons, ranked in the level (0.05) of moral indication. However, the lowest impractical with the value of $X^2$ reached 4.51 which is greater than scheduled value of the $X^2$ of 3.07 in this level of significance.
### Table 6. The results of questionnaire and Chi square value ($X^2$) of the direct reasons in the planning phase

| Rank  | Reason                                                                 | A lot | Average | Less | (X2) Chi Seq. Value |
|-------|------------------------------------------------------------------------|-------|---------|------|---------------------|
|       |                                                                        | No.  | %      | No.  | %      | No.  | %     | No.  | %     |       |       |       |       |
| 1     | Changing of the owner requirements                                     | 19   | 40.4   | 16   | 34.04 | 12   | 25.52 | 4.93 ** |
| 2     | Declaration of war, emergency and natural disasters in the country     | 9    | 19.15  | 14   | 29.79 | 24   | 51.06 | 4.24 ** |
| 3     | Lack of clarity in the requirements of the employer                     | 12   | 25.52  | 23   | 48.93 | 12   | 25.52 | 6.63 ** |
| 4     | Initial planning is impractical                                         | 14   | 29.78  | 19   | 40.42 | 14   | 29.78 | 4.51 ** |
| 5     | Change of requests by the employer                                      | 12   | 25.52  | 19   | 40.42 | 16   | 34.04 | 4.93*  |
| 6     | The complexity of the project                                           | 7    | 14.89  | 17   | 36.04 | 23   | 48.93 | 7.85 ** |
| 7     | The duration of the contract is unclear                                 | 7    | 14.89  | 16   | 34.04 | 24   | 51.06 | 8.19 ** |
| 8     | The basic data for the project is not sufficient                        | 19   | 40.4   | 19   | 40.42 | 9    | 19.1  | 6.74 ** |
| 9     | Inefficient planning and schedule                                       | 17   | 36.17  | 14   | 29.78 | 16   | 34.03 | 1.67 NS |
| 10    | The property disputes on the project land                               | 2    | 4.26   | 19   | 40.43 | 26   | 55.31 | 8.63 ** |
| 11    | Administrative complexity of the owner                                  | 12   | 25.52  | 21   | 44.68 | 14   | 29.78 | 6.03 ** |
| 12    | Poor choice for consultants                                             | 12   | 25.52  | 16   | 34.03 | 19   | 40.42 | 4.94*  |
| 13    | Slow fulfillment of requirements by the owner                           | 14   | 29.78  | 26   | 55.31 | 7    | 14.89 | 7.85 ** |
| 14    | Infectious diseases                                                     | 7    | 14.89  | 14   | 29.78 | 26   | 55.31 | 6.03 ** |
| 15    | Delay or stop the work by the owner                                     | 9    | 19.15  | 14   | 29.79 | 24   | 51.06 | 4.24*  |

*(P<0.05) • **(P<0.01) • NS: insignificant

According to the conclusion of the validation analysis, the above two tables indicted in it can be said that there are direct and indirect reasons facing the planning of the construction projects in the Iraqi environment and the significant reasons could be accounted for this corresponds to the paper assumption.

Based on the questionnaires outcomes of tables present the top ten reasons for the delay of the construction projects in the planning phase The ranking of the reasons has been done according to the hypothesis of Relative Importance Index Value Table (7) shows the (unavailability of the fundamental data for the projects) with index (0.73759) the highest powerful delay Reason in the planning phase and the second one was the (Changing of the owner requirements) got (0.71631). As well as the reason (Slow fulfillment of requirements by the owner comes as the third third-highest reason. On the other hand, (the Declaration of war, emergency and natural disasters in the country) ranked as the fifth delay reason.

### Table 7. The ten most important reasons of the delay in the planning phase

| Rank | Reason                                                                 | RII   | Importance level |
|------|------------------------------------------------------------------------|-------|------------------|
| 1    | The unavailability of the fundamental data for the projects            | 0.73759 | H                |
| 2    | Changing of the owner requirements                                     | 0.71631 | H                |
| 3    | Slow fulfillment of requirements by the owner                          | 0.71631 | H                |
| 4    | Inefficient planning and schedule                                      | 0.67376 | H                |
| 5    | Declaration of war, emergency and natural disasters in the country     | 0.66667 | H                |
| 6    | Lack of clarity in the requirements of the employer                    | 0.66667 | H                |
| 7    | Initial planning is impractical                                        | 0.65248 | M                |
| 8    | Administrative complexity of the owner                                 | 0.63830 | M                |
| 9    | Change of requests by the employer                                     | 0.61702 | M                |
3.2 The Design Phase

The collected choices of the questionnaires show that the reason for the delay (change of requests as a result of an error in reading the numbers) at the design phase comes first, as the value of the Chi-square $X^2$ was 11.62, while the reason (lack of good estimate tables) came second with value of $X^2$ equal to 9.73 and they are greater than the value of the scheduled $X^2$ 4.07 with significance at the level of (0.01) as well as the nine other values came with the same level of the moral significance. However, the other two direct reasons at level (0.05) and the lowest value has been gotten for the reason (slow decision-making by designers) with the value of $X^2$ 4.94 which is greater than the scheduled amount of value equal to 3.07 at this level of importance see Table (8).

Table 8. The results of questionnaire and Chi square value ($X^2$) of the direct reasons in the design phase

| Rank | Reason                                    | A lot | Average | Less | (X^2) | Chi Sq. Value |
|------|-------------------------------------------|-------|---------|------|-------|---------------|
| 1    | Changing of the owner requirements         | 21    | 44.68   | 14   | 29.78 | 12            | 25.53         | 6.02**        |
| 2    | There is no central management for designers | 7     | 14.89   | 28   | 59.57 | 12            | 25.53         | 8.59**        |
| 3    | Incomplete designs and specifications      | 17    | 36.17   | 14   | 29.78 | 16            | 34.04         | 1.56 NS       |
| 4    | Difference of designers views              | 2     | 4.25    | 17   | 36.17 | 28            | 59.57         | 8.84**        |
| 5    | Slow of designers decision-making         | 11    | 23.4    | 18   | 38.29 | 18            | 38.29         | 4.93*         |
| 6    | Poor of working experience of the designers | 10    | 21.27   | 28   | 59.57 | 9             | 19.14         | 8.71**        |
| 7    | Delay in transmission of information between designers | 16    | 34.04   | 12   | 25.53 | 19            | 40.42         | 4.94**        |
| 8    | The design period is unrealistic           | 16    | 34.04   | 14   | 29.78 | 17            | 36.17         | 1.62 NS       |
| 9    | Wrong cost estimation                     | 9     | 19.14   | 31   | 65.95 | 7             | 14.89         | 9.64**        |
| 10   | The design is wrong or inappropriate      | 2     | 4.25    | 19   | 40.42 | 26            | 55.31         | 8.58**        |
| 11   | Change of orders due to wrong reading of the numbers | 2     | 4.25    | 5    | 10.63 | 40            | 85.1          | 11.62**       |
| 12   | Façade design is not satisfied            | 9     | 19.14   | 7    | 14.89 | 31            | 65.95         | 9.64**        |
| 13   | The Difference of opinion on the requirement of the designs | 7     | 14.89   | 28   | 59.57 | 12            | 25.53         | 8.68**        |
| 14   | Poor of the good bill of quantities       | 7     | 14.89   | 33   | 70.21 | 7             | 14.89         | 9.73**        |
| 15   | The owner financial problems              | 26    | 55.31   | 19   | 40.42 | 2             | 4.25          | 8.52**        |
| 16   | Delay or stop the work by the owner       | 2     | 4.25    | 21   | 44.68 | 24            | 51.06         | 8.75**        |
| 17   | Declaration of war, emergency and natural disasters in the country | 12    | 25.53   | 7    | 14.89 | 28            | 59.57         | 8.69**        |

* (P<0.05)  ** (P<0.01)  NS: insignificant

As a result of the of the consequents design phase questionnaires, there are significant reasons that should be studied to mitigate the risks of the delay in the construction project for the Iraqi construction industry as it was assumed in the hypothesis of the research. The ranking of the reasons shown in Table (9) indicates the most significant ten reasons could be affected on project time works during the design phase. The result shows that (The owner financial issues) the top rank in the delay reason in this phase. (The declaration of war, emergency and natural disasters in the country) the second top one with RII value (0.83688 and 0.73050) Consecutively. In addition to the reason (Changing of the owner requirements) had been the third active one with total value to (0.68085) of RII.
Table 9. The ranking top ten reasons of the delay in the design phase.

| Rank | Reason                                                                 | Importance level | RII   | Reason                        |
|------|------------------------------------------------------------------------|------------------|-------|------------------------------|
| 1    | The owner financial issues                                              | H                | 0.83688 | 1. Declaration of war, emergency and natural disasters in the country |
| 2    | Declaration of war, emergency and natural disasters in the country     | H                | 0.73050 | 2. Changing of the owner requirements |
| 3    | Changing of the owner requirements                                      | H                | 0.68085 | 3. Wrong cost estimation      |
| 4    | Wrong cost estimation                                                   | H                | 0.67376 | 4. Incomplete designs and specifications |
| 5    | Incomplete designs and specifications                                   | H                | 0.67376 | 5. Poor of working experience of the designers |
| 6    | Poor of working experience of the designers                             | H                | 0.66667 | 6. Poor of the good bill of quantities |
| 7    | Poor of the good bill of quantities                                     | M                | 0.65957 | 7. The design period is unrealistic |
| 8    | The design period is unrealistic                                        | M                | 0.64539 | 8. Poor of the good bill of quantities |
| 9    | Delay in transmission of information between designers                   | M                | 0.63121 | 9. The design period is unrealistic |
| 10   | There is no central management for designers                            | M                | 0.63121 | 10. Delay in transmission of information between designers |

3.3 The Implementation Phase

Due to the importance and complication of this phase, the total proposed direct reasons reached up to 78 reasons. The validation process by using Chi-square analysis indicated that the reason for the delay (poor planning of work by the contractor) comes first with the value of the square of Chi ($X^2$) has reached to 11.47. Then, the reason (Poor of the contractor’s project's time estimation) under ($X^2$) value 10.41. They are greater than the scheduled value of $X^2$ of 4.07 since they are two values of significant significance at the level of (0.01). The other sixty-three values came with the same level of moral significance The next two reasons came under a moral significance level (0.05). The (material unavailability) with the lowest value in the table for in which the value of X2 reached 3.87 which is greater than the value of the scheduled $X^2$ of 3.07 in this level of significance. Table (10) shows the values of the delay reasons result from the Chi square analysis in the implementation phase.

Table 10. The results of questionnaire and Chi square value ($X^2$) of the reasons in the Implementation Phase

| Rank | Reason                                                                 | A lot     | Average | Less     | ($X^2$)Chi Seq. Value |
|------|------------------------------------------------------------------------|-----------|---------|----------|-----------------------|
| 1    | Changing the prices of materials                                       | No. 12    | 25.52   | 26       | 55.31                 | 9  19.14   | 7.56**    |
| 2    | Unavailability of the materials                                        | No. 14    | 29.78   | 19       | 40.42                 | 14  29.78  | 3.87*     |
| 3    | Changing specifications of materials                                  | No. 12    | 25.52   | 19       | 40.42                 | 16  34.04  | 4.93*     |
| 4    | Delay of supplying the materials                                      | No. 17    | 36.17   | 21       | 44.68                 | 9   19.14  | 6.05      |
| 5    | Poor of the work equipment efficiency                                 | No. 14    | 29.78   | 28       | 59.57                 | 5   10.63  | 8.23**    |
| 6    | Increasing of work equipment malfunction                              | No. 14    | 29.78   | 21       | 44.68                 | 12  25.53  | 6.89**    |
| 7    | Shortage of the work equipment                                        | No. 16    | 34.04   | 24       | 51.06                 | 7   14.89  | 8.41**    |
| 8    | Shortage of skilled and unskilled labors                              | No. 26    | 55.31   | 19       | 40.42                 | 2   4.25   | 8.72**    |
| 9    | Lack of skill of the labors                                           | No. 26    | 55.31   | 19       | 40.42                 | 2   4.25   | 8.72**    |
| 10   | Poor of the technical qualification of contractor staff                | No. 28    | 59.57   | 14       | 29.78                 | 5   10.63  | 7.95**    |
| 11   | Poor management of the contractor staff                               | No. 28    | 59.57   | 17       | 36.17                 | 2   4.25   | 8.56**    |
| 12   | The contractor poor planning of the work                              | No. 40    | 85.1    | 5        | 10.13                 | 2   4.35   | 11.47**   |
| 13   | Inefficiency of the implement method                                  | No. 19    | 40.42   | 26       | 55.31                 | 2   4.25   | 8.53**    |
| 14   | Miss controlling in the quality by the                               | No. 28    | 59.57   | 14       | 29.78                 | 5   10.63  | 9.64**    |
| Contract Issue                                                                 | Code | Probability | Time Lost | Impact | Importance |
|--------------------------------------------------------------------------------|------|-------------|-----------|--------|------------|
| Lack of control of the contractor on the subcontractors                       | 15   | 26          | 55.31     | 19     | 40.42      | 2          | 4.25     | 9.25**    |
| Miscalculation of the contractor for project time                             | 16   | 35          | 74.46     | 7      | 14.89      | 5          | 10.63    | 10.41**   |
| There is no time schedule for the project                                     | 17   | 33          | 70.21     | 914    | 19.14      | 5          | 10.63    | 9.85**    |
| Lack of commitment of the project progress schedule                           | 18   | 31          | 65.91     | 14     | 29.78      | 2          | 4.25     | 9.13**    |
| Lag of preparing the change orders                                            | 19   | 12          | 25.35     | 28     | 59.57      | 7          | 14.89    | 8.56**    |
| Delay of preparing and surveying the project site                             | 20   | 5           | 10.63     | 30     | 63.83      | 12         | 25.53    | 8.75**    |
| Lack of the coordination with the project team                                | 21   | 14          | 29.78     | 21     | 44.68      | 12         | 25.53    | 6.03**    |
| Selling the contract for more than one time                                   | 22   | 35          | 74.46     | 7      | 14.89      | 5          | 10.63    | 9.66**    |
| Poor of contractor for project time                                           | 23   | 35          | 74.46     | 12     | 25.53      | 0          | 0        | 9.85**    |
| Financial problems of payment with secondary contractors                      | 24   | 33          | 70.21     | 12     | 25.53      | 2          | 4.25     | 9.60**    |
| Delay of handing the project site to the contractor                           | 25   | 12          | 25.53     | 21     | 44.68      | 14         | 29.78    | 6.03**    |
| The dedicated time period for the completion of the work is insufficient       | 26   | 9           | 19.14     | 26     | 55.31      | 12         | 25.53    | 7.95**    |
| Lack of the client cash                                                       | 27   | 26          | 55.31     | 14     | 29.78      | 7          | 14.89    | 8.27**    |
| Overdue the client to approve the change orders                               | 28   | 9           | 19.14     | 24     | 51.06      | 14         | 29.78    | 8.53**    |
| The client lateness for decision-making                                        | 29   | 12          | 25.53     | 28     | 59.57      | 7          | 14.89    | 7.64**    |
| The client undertakes works that conflicts with the contractor's work         | 30   | 2           | 4.25      | 21     | 44.68      | 24         | 51.06    | 8.95**    |
| Multiplicity of Client change orders in the project                           | 31   | 5           | 10.63     | 26     | 55.31      | 16         | 34.04    | 8.57**    |
| The contractor did not receive the required layouts.                          | 32   | 9           | 19.14     | 19     | 40.42      | 19         | 40.42    | 7.84**    |
| The multiplicity of supervising and receiving committees and the frequent change of supervisors | 33   | 19          | 40.42     | 19     | 40.42      | 9          | 19.14    | 7.84**    |
| Quantitative and technical mistakes in bill of quantities                     | 34   | 16          | 34.04     | 24     | 51.06      | 7          | 14.89    | 7.91**    |
| There is unclear items in the bill of quantities                              | 35   | 12          | 25.53     | 21     | 44.68      | 14         | 29.78    | 6.03**    |
| Technical and administrative inexperience of the supervisor engineer          | 36   | 14          | 29.78     | 28     | 59.57      | 5          | 10.63    | 8.69**    |
| Shortage and unclear in the layout of project                                 | 37   | 12          | 25.53     | 21     | 44.68      | 14         | 29.78    | 6.03**    |
| The intervention of the client in implementation methods                      | 38   | 7           | 14.89     | 28     | 59.87      | 12         | 25.53    | 8.74**    |
| The lateness of supervisor engineer for the contractor Requests               | 39   | 12          | 25.03     | 26     | 55.31      | 9          | 19.14    | 7.95**    |
| Poor of the contractor’s project's time estimation.                           | 40   |             |           |        |            |            |          |           |
| The supervising engineer is not                                               | 41   | 21          | 44.68     | 21     | 44.68      | 5          | 10.63    | 6.82**    |
42. The discretion of the supervisor engineer in the interpretation of layouts and specifications  
   |  |  |  |  |  |  |
   | 9 | 19.14 | 26 | 5536 | 12 | 25.53 | 7.95** |

43. The supervisor engineer query of the implemented works  
   |  |  |  |  |  |  |  |
   | 16 | 34.04 | 17 | 36.17 | 14 | 29.78 | 1.61NS |

44. The supervisor engineer is adopting the traditional method in communication with the project team  
   |  |  |  |  |  |  |  |
   | 12 | 25.53 | 21 | 44.68 | 14 | 29.78 | 6.03** |

45. Poor experiences of the design team in the project  
   |  |  |  |  |  |  |  |
   | 14 | 29.78 | 26 | 55.31 | 7 | 14.89 | 7.85** |

46. The supervisor Engineer is stresses to implement with technical specifications  
   |  |  |  |  |  |  |  |
   | 17 | 36.17 | 16 | 34.04 | 14 | 29.78 | 1.64 NS |

47. Delay the client to pay the financial contracting dues  
   |  |  |  |  |  |  |  |
   | 19 | 40.42 | 21 | 44.68 | 7 | 14.89 | 7.64** |

48. Difficulty in financing the project  
   |  |  |  |  |  |  |  |
   | 31 | 65.95 | 14 | 29.78 | 2 | 4.25 | 9.48** |

49. There is no work progress schedule for the project  
   |  |  |  |  |  |  |  |
   | 28 | 59.57 | 19 | 40.43 | 0 | 0 | 9.74** |

50. Poor financial management of project contractor  
   |  |  |  |  |  |  |  |
   | 19 | 40.43 | 21 | 44.68 | 7 | 14.89 | 7.85** |

51. The lateness of the designer for preparing the required detailed layouts  
   |  |  |  |  |  |  |  |
   | 14 | 29.78 | 21 | 44.68 | 5 | 10.63 | 8.51** |

52. The lateness of the designer for the contractor requests and clarifications  
   |  |  |  |  |  |  |  |
   | 12 | 25.53 | 21 | 44.68 | 14 | 29.78 | 6.03** |

53. Poor cooperation of the designer with the project team  
   |  |  |  |  |  |  |  |
   | 7 | 14.89 | 26 | 55.31 | 14 | 29.78 | 8.62** |

54. The disagreement of the designer for the proposed alternatives that have the same specifications  
   |  |  |  |  |  |  |  |
   | 9 | 19.14 | 31 | 65.95 | 7 | 14.89 | 9.69** |

55. The lateness of the designer for the preparing giving alternatives best on result of tests  
   |  |  |  |  |  |  |  |
   | 12 | 25.53 | 30 | 63.83 | 5 | 10.63 | 8.91** |

56. The period of the implementation in the initial planning and design not enough  
   |  |  |  |  |  |  |  |
   | 9 | 19.14 | 14 | 29.78 | 24 | 51.06 | 8.46** |

57. The Circumstances of the site is defer that in contract documents  
   |  |  |  |  |  |  |  |
   | 31 | 65.91 | 14 | 29.78 | 2 | 4.25 | 9.13** |

58. Multiple contractor financial obligations  
   |  |  |  |  |  |  |  |
   | 21 | 44.68 | 19 | 40.42 | 7 | 14.89 | 7.92** |

59. There is long time between the estimation and actual implementation in the project  
   |  |  |  |  |  |  |  |
   | 21 | 44.68 | 24 | 44.68 | 5 | 10.63 | 7.98** |

60. The total estimated cost is wrong  
   |  |  |  |  |  |  |  |
   | 16 | 34.04 | 26 | 55.31 | 5 | 10.63 | 8.17** |

61. The late fines is not active  
   |  |  |  |  |  |  |  |
   | 12 | 25.53 | 14 | 29.78 | 21 | 44.68 | 6.03** |

62. The difficulty of getting the construction permit  
   |  |  |  |  |  |  |  |
   | 12 | 25.53 | 2 | 4.25 | 33 | 70.21 | 9.58** |

63. The changes in the laws and regulations of construction  
   |  |  |  |  |  |  |  |
   | 31 | 65.95 | 7 | 14.89 | 9 | 19.14 | 8.55** |

64. Assigning the contract to the lower bidding  
   |  |  |  |  |  |  |  |
   | 14 | 29.78 | 24 | 51.06 | 9 | 19.14 | 8.71** |

65. Govern the law of admonition in the contracting contracts  
   |  |  |  |  |  |  |  |
   | 5 | 10.63 | 16 | 34.04 | 26 | 55.31 | 8.64** |

66. Creating new taxes during the implementation of the project  
   |  |  |  |  |  |  |  |
   | 5 | 10.63 | 24 | 51.06 | 9 | 19.14 | 8.71** |
Consequently, the result of the validation analysis of the assumption indicated the delay reasons analysis by the Chi-square test in the implementation phase of the construction projects in the Iraqi present there are significant delay reasons that should be taken care during execute the construction project. Based on the questionnaire outcomes, Tables 11 shows the top ten reasons for the delay of the construction projects in the planning phase. The ranking of the reasons has been done according to the hypothesis the Relative Importance Index (RII) get the total value of each reason. The most affective one was (The terrorist acts and Cut off roads) with the value of (0.93617). The Second highest reason the result fond is (The contractor poor planning of the work) gets (0.91489) and the (Poor of contractor of availability of cash) came as a third reason can cause delay the project.

### Table 11. The ranking top ten reasons of the delay in the implementation phase

| Rank | Reason                                              | RII         | Importance level |
|------|-----------------------------------------------------|-------------|-----------------|
| 1    | The terrorist acts and Cut off roads                | 0.93617     | H               |
| 2    | The contractor poor planning of the work            | 0.91489     | H               |
| 3    | Poor of contractor of availability of cash          | 0.88652     | H               |
| 4    | Financial problems of payment with secondary contractors | 0.87943 | H               |
| 5    | Poor of the contractor’s project's time estimation. | 0.87943     | H               |
| 6    | Selling the contract for more than one time         | 0.87234     | H               |
| 7    | lack of commitment of the project progress schedule | 0.87234    | H               |
| 8    | Difficulty in financing the project                 | 0.86525     | H               |
| 9    | There is no work progress schedule for the project | 0.86525     | H               |
| 10   | Poor financial management of project contractor     | 0.86525     | H               |

### 4. Conclusions and Recommendations

In summary, this paper aimed to investigate the effective delay reasons in Iraqi construction projects during the planning, design and implementation phases under the attack of terrorism. The results demonstrated that the highest reason that affects delay in the planning phase is the unavailability of the fundamental data for the projects in this phase. On the other hand, the questionnaire analysis results confirmed the owner's financial issues were the effective delay reasons during the design phase.
Furthermore, the most influential delay’s reason in the implementation phase the terrorist acts and cut off roads which concluded as the essential reason cause delay in construction projects in Iraq during the period of study. This research paper recommends creating a database of construction projects to be used in planning future projects. As well as, the owners and contractors should provide the financial support to reduce the delay time in the projects. Moreover, adopting risk analysis and management strategies to mitigate the effects of the natural hazards on construction projects. Finally, the contractors have to employ qualified engineers in the field of construction project planning.

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