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Study and Analysis of the Delay Problems in Iraqi Construction Projects

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Abstract: ***Delays in of construction projects is a problem, suffered by all construction projects in the world, and this problem is very large in Iraq, where a very small percentage of the construction projects were completed within the contractual period and especially in the last period due to circumstances experienced by the country, and this led to negative effects on the society and on the economic side of the country. This study aims to identify the key factors that cause delays in the construction projects, to achieve this goal has been studied the problem of delay in a six construction projects in Iraq and hold interviews with a group of engineers working experts in the competent departments of construction projects in Iraq. In addition, a questionnaire survey was conducted to groups of engineers who have an experience in the construction industry for identifying the key causative factors of delay. The results of this study identified forty-eight key factor causes the delay in the construction projects of Iraq, where the factor of lack the financial capacity of the contractor during the execution having the most effect on the occurrence the delay and followed by other factors. The benefit of identifying the causative factors for the delay is to provide a database for decision-makers for managing time well by taking effective measures to reduce delays in the construction projects.***

Keywords: Construction Project, Delay, Causative Factors, Effect

1. Introduction

The construction industry is one of the main sectors that provide an important ingredient for the development of an economy [1], [2]. However, many projects experience extensive delays and thereby exceed initial time and cost estimates. Construction delays are considered to be one of project success in term of time, cost, quality, and safety [3]. The construction industry has some shortcomings such as poor understanding of the project, lack of modern equipment, incompetent contractors, etc .This problem can easily occur and lead to a negative impact on the result of the construction project [4]. The time and cost for the performance of a project are usually important to the employer and contractor. About 57% of Indian construction projects are experiencing time overrun. These time overruns always contributed as expensive to all parties [5]. In Saudi Arabia, Reference [6] found out that only 30% of construction projects have been completed within the contracted deadlines, and the average slipping period was between 10% and 30%. In recent years, Iraqi economy has improved largely, following the growth of oil sector, infrastructure development and the urbanization are booming. However, many construction projects in Iraq have the delay on the specified time and can say that a little, if not rarely find project has been implemented within the time period specified in the contract document without any delay [7].

2. Delay in Construction Projects

Construction delays are a global phenomenon since one of the most important problems in the Construction industry is a delay [8], [9]. Delays occur in every construction project and the magnitude of these delays varies considerably from project to project. In the construction context, the word "delay'' refers to something happening at a later time than planned, beyond the date that the parties agreed upon for the delivery of a project. Delay was defined as the slowing down of work without stopping construction entirely and that can lead to time overrun beyond the date that the parties have agreed upon for the delivery of the project. Delays occur in every construction project and the significant of these delays varies considerably from project to project [10]. Reference [11] in 2012 confirmed that 51% of the delay responsibility lies with the enterprises, followed by the project manager 30% and the client 19%. The delay factors are very crucial within a construction project and it is vital that all organizations must have certain knowledge regarding this issue in order for the project to be completed effectively and satisfactorily [12]. Over the last decade, researchers have looked into the causes and effects of delays in construction projects. The effect of delay for the owner causes the following problems, losing revenue of the construction project, inflation, increase of workers' remuneration, and price of materials and raw materials for completion of the project etc. While for contractors, construction delays refer to top prices, long work length, high labor costs, materials and redoubled instrumentation refers to prices etc [7]. The construction projects are facing with uncertain and unpredicted factors that may result in a delay in completion of the project. Generally, the origin of the delay includes teams involved in the project, available resources, environmental conditions, interference of third parties and contractual relationships [13]. The literature and previous studies classified the causative factors of construction delay according to groups as shown in Table (1).

Table 1: Classification of The origins of Delay Causative Factors According to The Previous Studies

Previous Studies	*The Origins of Delay Causative Factors*														
	Project	Contract	Financial	Design	Owner	Clint	Consultant	Designer	Contractor	Sub-contractor	Materials	Equipment	Manpower	Environment	External
[14]	√					√	√	√	√		√	√	√		√
[15]	√			√	√		√		√		√	√	√	√	√
[16]					√		√	√	√		√	√	√		√
[3]						√	√		√						√
[1]	√		√	√	√	√	√		√		√	√	√		√
[17]	√	√			√		√		√	√	√	√	√		√
[10]						√	√		√						√
[18]						√	√		√						
[19]						√	√		√						√
[20]					√	√	√		√						
[21]					√		√		√		√	√	√		√

3. Field Study

For obtaining the actual information on the problem of delays in the Iraqi construction projects, a field study was divided into the following areas:

3.1 Case Study

The researcher has conducted a field study of a group of construction projects which are located in Iraq which numbering six construction projects (two projects completed, four projects under construction) differ in their completed percentages and their employers, information on each project are shown in Table (2), for studying the problem of delays and identifying the problems that occurred and led to project delay. It was obtained information about the delay in the completed projects under study by reviewing the records and documents of each project (such as the contract document, variation orders, additional durations, payments, and design drawings). As for the non-completed projects under study were obtained information about the delay, by conducting interviews with the project managers and the engineers' staff of these projects, in addition to a review of records and documents of each project. The problems that have occurred in the construction projects under study and led to the delay has been identified, and also its impact on the projects. Table (3) shows the problems that have occurred in all the projects under study and its impact.

Table 2: Description of The construction Projects that Covered in The study.

Project	*Client*	*Completion Percentage*	*Work Sector*	*Description*
P1	Ministry of Construction and Housing	100 %	Public	A project of constructing a three - story building.
P2	Baghdad Governorate	100 %	Private	A project of constructing a W.W.T. Plant.
P3	Ministry of Construction and Housing	81.7 %	Public	A project of constructing a building contain five floors.
P4	Ministry of Construction and Housing	70.7 %	Private	A project of constructing a church, consists three floors.
P5	Baghdad Governorate	10 %	Private	Infrastructure project in the Latifiya zone.
P6	Baghdad Governorate	9 %	Private	A project of constructing a building consists of ten floors.

Table 3: The Problems that Happened In Construction Projects that Covered in The Study.

The Problems	*p1*	*P2*	*P3*	*P4*	*P5*	*P6*
1) Use labors that are not qualified and unskilled.				√		
2) There is not schedule time for the process of supplying materials.	√		√			
3) There is not enough space to store construction materials within the project site.				√		
4) The impact of bad weather conditions on the execution activities in the project.	√	√	√	√	√	
5) The existence of activities cannot be implemented because of the estimated prices in BOQ incorrect.	√					
6) The delay in the project location delivery to the contractor.	√	√	√	√	√	
7) The changes in government regulations and laws during the execution of the project.						√
8) Stop the project more than once because the rate of the public holidays and public events in a country is high.	√	√	√	√	√	√
9) Stop in the project works because of Inadequate the financial allocations.					√	√
10) Re-working of some work activities because of execution errors.	√			√		
11) Non-use of labor in sufficient numbers.				√		
12) Miscalculation of the project timeline and the quantities of required materials.				√		
13) Lack of the construction materials in the local markets.	√		√			
14) Lack of financial capacity of the contractor.				√		
15) Lack of the accuracy of the works topographic survey.		√				
16) High water table during the execution of the project.	√	√		√		
17) Delay of contractor's payments by the client.					√	√
18) Delay in the approval process of the designs and materials specifications.		√	√	√	√	

The Problems	*p1*	*P2*	*P3*	*P4*	*P5*	*P6*
19) Damage in service networks which passing under a project land during the excavation works.				√		
20) Damage caused by poor storage of construction materials.				√		
21) Contracting with an incompetent contractor.	√			√		
22) Construction project location is unsuitable.					√	√
23) Closure of the roads leading to the project site during the execution because of the security situation in the country.	√	√	√	√	√	√
24) Claims and problems because of the contractor Dissatisfaction on the additional durations.		√				
25) Changes in the types and specifications of materials during execution project.	√		√		√	√
26) BOQ includes a large number of import paragraphs for construction materials.		√				
27) Bad the security conditions around the project site.		√			√	
28) An occurrence of accidents for workers as a result of working in hazardous conditions.					√	
29) Add new activities and changes in some work activities during the construction phase by the employer.	√	√	√	√	√	√
30) A mismatch between the drawings designs.				√		
31) A mismatch between the design drawings and BOQ.		√			√	

3.2 Interviews with Experts

The researcher has conducted a personal interviews with a group of experts from engineers working in the field of design, planning, management and execution of the construction projects in the competent departments in Iraq government and the public sector companies (such as: Mayoralty of Baghdad, Buildings Directorate, The Housing Directorate, National Center for Engineering Consultancy, Bridges & Roads Directorate, Al-Rashid State Company for Construction Contracting, Al-Mutasim State Company for Construction Contracting), as well as a range of private sector companies, for the purpose of gathering more information about the problem of delay in the Iraqi construction projects. It identified the origins of delay problem in the construction projects, the cause and effect diagram was used to show these origins as shown in Figure (1). In addition, preparation for designing the form of a Questionnaire survey, which will be explained in the next paragraph.

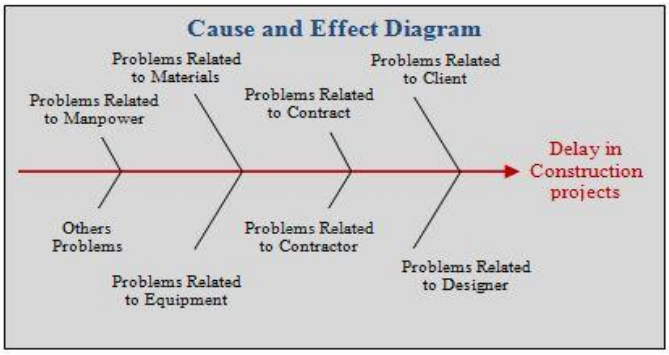

Figure 1: Cause and effect diagram for the delay problem.

3.3 Questionnaire Survey

From previous studies, the projects under study and interviews with experts, the researcher concluded a group of causative factors of delay in the construction projects of Iraq. For ranking these causative factors according to their degree of effect and exclusion the factors that have a little effect, the researcher conducted a questionnaire survey to a group of engineers who work in the construction industry in Iraq from different engineering fields. The questionnaire form consists of seventy-eight (78) causative factors distributed to the eight origins groups that identified in the previous paragraph. The sample size (N) consisted of forty-one (41) forms after excluding the incorrect forms, The field of specialization, work experience, and work sector for the participants, are given in Figure (2, 3, and 4) respectively. Five Likert-scale was used for collect the participants' answers, and Statistical Package for Social Sciences (SPSS) program was used for the statistical analysis of the questionnaire data by calculating the arithmetic mean and standard deviation according to equations (1), & (2), respectively. In addition, to calculate the value of Alpha Cronbach's coefficient (α) this refers to the degree of internal consistency of the scale. If the value of the Alpha Cronbach (α) is high (close to one), this already indicates the reliability of the questionnaire [22], [23], and the coefficient of Cronbach Alpha is supposed not less 0.70 [24], [25], [26]. The result of questionnaire survey identified forty-eight key causative factors of the delay in the construction projects, which have a high and very high effect, and the maximum value of (α) for these key causative values equal (0.951) and the minimum value equal (0.949) according to equation (3). Table (4) shows the values of the Mean (M), Standard Deviation (S.D) and Alpha Cronbach's coefficient (α) for the key causative factors of the delay in the construction projects. PARETO chart was used to identify the size of each origin groups from the delay problem according to values of mean, which calculated in the Table (4), as shown in Figure(5).

$$M = \left(\sum_{i=1}^{k} x_i \times f_i \right) \Big/ n \qquad (1)$$

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

$$Cronbach(\alpha) = \left[\frac{k}{(k-1)}\right] \times \left[1 - \frac{\left(\sum S_i^{\,2}\right)}{\left(S_{sum}\right)^2}\right] \quad (3)$$

Where:
M: Mean.
S.D: Standard Deviation
x_i: Weight Value for particular.
f_i : Number of frequencies.
n: The total number of answers.
S_i : The Variance for the current sample of respondents.
k: Is the total number of delay factors.
S_{sum} : is the variance of the sum of all respondents.

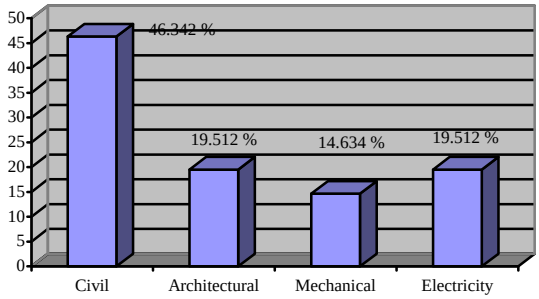

Figure 2: The percentage of Study Sample According to Engineering Specializations.

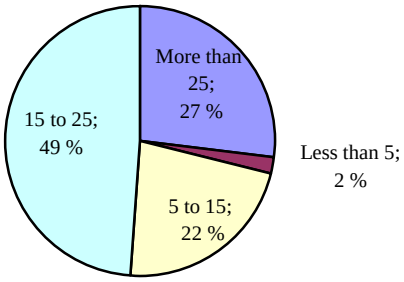

Figure 3: The percentage of Study Sample According to Experience Years.

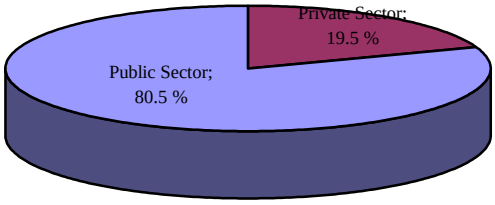

Figure 4: The percentage of Study Sample According to Work Sector.

Table 4: The key Causative Factors of The delay

Key Causative Factors	*M*	*S.D*	*α*	*Effect Level*
1- Delay Factors related to Client				
1) Inadequate the financial allocations.	4.61	0.542	0.950	Very High
2) Delay the contractor's payments by the client	4.34	0.794	0.951	Very High
3) Choose the design team who does not have efficiency.	4.32	0.789	0.950	Very High
4) Stop the work in the project due to causes related to the employer.	4.17	0.863	0.950	High
5) The employer does not have an adequate experience.	4.15	0.853	0.949	High
6) Change the designs by the employer during the execution phase.	3.93	0.787	0.950	High
7) The delay in the project location delivery to the contractor.	3.85	0.989	0.950	High
8) Delay in the approval process of the designs and materials specifications.	3.78	0.962	0.949	High
9) lack in accuracy of topographic surveys for the project site.	3.68	0.986	0.950	High
2- Delay Factors related to Designer				
10)There is a difference between the design drawings of all specializations.	4.27	0.742	0.950	Very High
11)A mismatch between the designs drawings and BOQ.	4.17	0.998	0.950	High
12)The inadequacy of experience of the design team.	4.12	0.900	0.949	High
13)Inaccuracy or lack of maps for the networks of service that pass under the project site (such as power lines, water, etc.).	4.10	0.970	0.950	High
14)The existence of activities cannot be implemented because of the estimated prices in BOQ incorrect.	3.51	0.870	0.950	High
3- Delay Factors related to Contract				
15) Contracting with an incompetent contractor.	4.59	0.706	0.951	Very High
16) Legal disputes between the various parties involved in the project	3.95	0.835	0.949	High
17) The original contract period is too short.	3.90	0.831	0.950	High
18) Choose the delivery contract type is not suitable for the assignment of the project (the negotiation, the lowest price, direct invitation etc).	3.78	0.962	0.949	High
4- Delay Factors related to Contractor				
19) Lack of financial capacity of the contractor.	4.73	0.449	0.950	Very High
20) Poor management and supervision at the site.	4.29	0.680	0.949	Very High
21) Poor planning and scheduling of the project.	4.24	0.734	0.949	Very High
22) Frequent change of the subcontractors because of inefficient their work.	4.10	0.800	0.950	High
23) Re-working of some works because of execution errors.	4.02	0.651	0.949	High
24) Use inappropriate the construction methods and not developed.	4.00	0.707	0.949	High
25) Frequent changes in the project schedule by the contractor.	3.88	0.748	0.950	High
26) Not develop a plan for risk management in the project.	3.76	0.799	0.949	High
27) Lack of qualification & training for the contractor team.	3.73	0.867	0.949	High
28) Poor relationship between staff and senior management for the contractor.	3.61	0.891	0.949	High
29) Frequent disputes between the subcontractors during the	3.49	0.978	0.949	High

Key Causative Factors	*M*	*S.D*	*α*	*Effect Level*
project execution.				
5- Delay Factors related to Materials				
30) There is no schedule to supply the construction materials.	4.05	0.835	0.950	High
31) Supplying of construction materials non-conform to the specifications.	4.00	0.949	0.949	High
32) Lack of materials at the site or the market.	3.95	0.865	0.950	High
33) Not conduct the necessary laboratory tests for construction materials before use	3.80	0.749	0.949	High
34) The changes in the types and specifications of the materials during the execution.	3.56	0.976	0.949	High
35) Delays in the manufacturing process of special building materials.	3.46	0.869	0.949	High
36) Damages caused by poor storage of construction materials.	3.44	0.896	0.949	High
6- Delay Factors related to Equipment				
37) Obsolescence of equipment life.	3.59	0.836	0.949	High
7- Delay Factors related to Manpower				
38) Use labor who are not qualified or unskilled.	3.98	0.790	0.950	High
39) Non-use of labor in sufficient numbers.	3.83	0.863	0.949	High
40) The difficulty of using skilled labor in some projects because of the poor security conditions.	3.63	0.888	0.950	High
8- Others (External) Delay Factors				
41) An occurrence of economic crises in the country during the execution of the project.	4.05	0.893	0.950	High
42) The existence of disputes in the land of the project.	3.85	0.989	0.949	High
43) The inaccuracy of the reports of soil investigations test, in terms of the number of test points and the depth of a point.	3.83	0.972	0.950	High
44) The multitude of official holidays and public events.	3.80	0.980	0.951	High
45) Delays in approvals related to the official bodies to work on the project.	3.73	0.975	0.949	High
46)Bad the security situation lead to a closure of roads leading to the project during the execution.	3.71	0.929	0.950	High
47)Lack of communication and coordination between the parties involved in the project (the employer, contractors and sub-contractors, designers and consultants, employees and suppliers).	3.66	0.938	0.950	High
48)Delay in issuing the results of the project laboratory tests by the competent authorities.	3.41	0.805	0.950	High

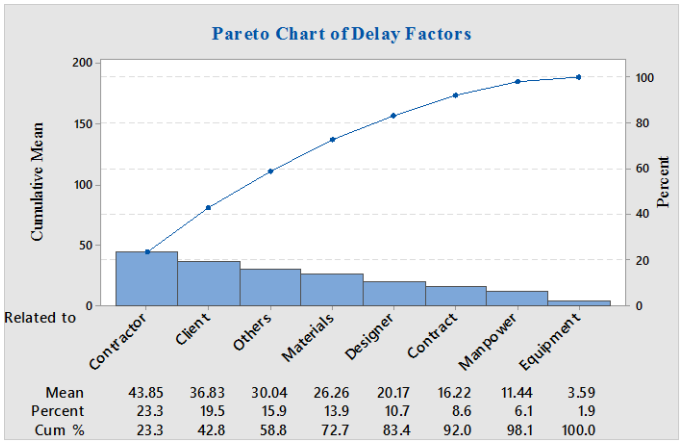

Figure 5: Pareto Chart for The origins Groups of Delay.

4. Conclusion

The researcher concluded from the construction projects which covered in this study and the experts' interviews, the most of the construction projects in Iraq having a delay in the execution period but it's ratio vary from project to other. There are eight origins to the delay problem in the construction projects as follow: Clint, Designer, Contract, Contractor, Materials, Equipment, Manpower, and External factors. As a result of a questionnaire survey, forty-eight key factors was identified that causes the delay in the construction projects, these key factors distributed into the eight origins groups listed above. Where was the factor of inadequate the financial allocations having the most effect to cause the delay in the group associated with the client, and the factor of an existence a difference between the design drawings of all specializations having the most effect to cause the delay in the group associated with the designer. While the factor of contracting with an incompetent contractor, the factor of lack the financial capacity of the contractor during the execution, the factor of there is no schedule for supplying of the construction materials, the factor of obsolescence of construction equipment life or disabled while working, and the factor of use the labor is not qualified or unskilled having the most effect to cause the delay in the group associated with (the contract, the contractor, the materials, the equipment, and the manpower), respectively. The factor of occurrence of economic crises in the country during the execution of the construction project, having the most effect to causes the delay in the group associated with others (external) factors. The treatment of the main factors associated with the Contractor, Client, and External factors, will contribute to solving 58.8 % of a problem of occurrence the delay in the construction projects.

Finally, the researcher suggests using the modern methods and principles in project management as a principle of agile management to reduce and control the delay in the construction projects.

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