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FACTORS OF DELAY IN PUBLIC CONSTRUCTION PROJECTS IN THE KURDISTAN REGION OF IRAQ

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ABSTRACT

Delay in public construction projects sector has become a phenomenon in construction industry in the developing countries. Iraqi Kurdistan Region has deprived of many valuable scientific and exclusionary researches have studied delay in this sector for decades, due to the fact that, projects in this region are not subjected to the same standards and administrative laws as those of the central government of Iraq. Therefore, determining and ranking the main delaying factors of the PCPs in the Kurdistan region of Iraq is the main objective of this publication, by reviewing and presenting previous publications in this regard and conducting a survey, involving the most important factors related to the main participants in the construction industry processes (client, contractor, consultant) in addition to the external factors, that affect the implementation of public construction projects, Responses were collected and analyzed to obtain the key delay factors by finding the frequency, impact and importance indexes of the four groups (client, contractor, consultant and the external factors). The results showed that out to twelve top ranked factors, six contractor related factors, three client related factors, two external related factors and one consultant related factors.

KEYWORDS: Delay in implementation; Construction projects; Kurdistan Region of Iraq.

1. INTRODUCTION

The delay has become an inevitable phenomenon in PCPs in developing countries due to interaction of many design-related factors and implementation technologies by the three parties (client, contractor, consultant) involved in the construction industry. (Bekr, 2015) defined the delay as an extension or exceeding the period of time previously agreed between the client and the contractor to complete and handover the project therefore, delay might be defined as a failure to handover the project within the project deadline, in accordance to the in advance agreement, between both the client and the contractor due to different known or unknown reasons. In order to avoid or reduce this phenomenon, it is important to study the actual and true delay causes. There are many research studies demonstrated delay reasons in PCPs in developing countries, such as a study of the time and cost exceeding in infrastructure projects in Nigeria by (Mansfield et al., 1994) and analysis of the reasons for delay in implementation of projects in Egypt by (Amer, 1994) to determine the real reasons for delaying the completion of the construction projects in Egypt as a developing country in order to accelerate the achievement of projects handover. In Saudi Arabia, PCPs have suffered from a time-out problem, as presented in the study by (Majid et al., 2016) which has examined (131) of delay causing factors of delay construction projects in

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Saudi Arabia. In the state of Thailand which is one of the developing countries that have their projects delayed in implementation period highlighted by (Ogunlana et al., 1996) in a comparative study of the reasons for the delay in Thailand's projects.

Studies by (Assaf et al., 1995), (Al-Khalil and Al-Ghafly, 1999), and (Assaf and Al-Hejji, 2006), was to conduct the factors causing delay in project structural in Saudi Arabia, by targeting the main parties participating in producing the PCPs (client, contractor and consultant) through surveys has identified, in the first study (56) delay factors ,(60) causes of delay in the second study and(73) delay reasons in the third study. Poor planning, numerous design changes, lack of qualified technical staff and lack of resources are also among the main reasons for delays in PCPs in Indonesia, as demonstrated in a study by (kaming et al., 1997). A study showed another statement of the delay reasons for the construction projects in Hong Kong by (Kumaraswamy et al., 1998), parties involved in the construction process in Hong Kong demonstrated differences in views the delay factor in the Hong Kong public projects. The most important delay factors in the PCPs conducted in Jordan by (Al-Momani, 2000), included 130 PCPs, the researcher highlighted the economic conditions, special circumstances of the environment, the location of the work and vibration orders by the client as the key delay factors of Jordanian public construction sector.

In Malaysia (Alaghbari et al., 2007) considered thirty-one factors of delay in Malaysia. Similarly, (Sambasivan and Soon, 2007), studied the causes and consequences of delay in Malaysian construction industries, however, (Sweis et al., 2008) studied financial difficulties and variation orders frequent change in the project as the main causes of delay of construction projects in that country. (Shebob et al., 2011) stated that changes in the project, lack of decision-making, lack of experience and poor planning were the most important causes of delay in construction PCPs in Libya. (Amr, 2013) modeled the delay rate for construction projects in Egypt Using Statistical-Fuzzy Approach, Also, (Remon, 2013) classified ninety-nine factors as delaying construction projects in Egypt after the Egyptian revolution. (Henry et al., 2013) investigated the 22 significant and time-consuming factors in Uganda's construction enterprise sector. In Ethiopia two studies were conducted to examine the causes of delay of public projects the first study was by (Zinabu, 2016) deliberated forty-one cause of the delay and the second study was by (Werku and Jha, 2016) highlighted eight-eight influential reasons of delay of construction projects in Ethiopia. (Qadir et al., 2019) Identified factors of delay in Oman Construction. Finally, (Yousif, 2017) studied delay impacts on the safety management in the construction projects in a comparative study between Iraq and the United kingdom, whereas, in other study also by (Yousif, 2018), business risks (cost and time) management in construction projects have identified and assessed to reduce construction projects hazard.

2. DELAY CLASSIFICATION

Regarding to delay types in PCPs, (Bekr, 2015), (Ahmed et al., 2003), (Bolton, 1990) and (Bramble and Callahan, 1987) classified the delay into:

Justified delay: It can be defined as the delay caused by reasons beyond the control of the contractor, and the delay may be compensable or not compensable according to the contracting bond.

Unexplained delay: It can be defined as the delay caused by reasons related to poor planning, implementation or expectation of the contractor, and not taking into consideration some important basic matters related to the risks of the

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construction process, in the normal, non-emergency circumstances that the contractor should have anticipated, the occurrence of those causes of the delay and exceeded, by setting alternative plans or implicitly calculate the delay period during the project scheduling and calculation, so the delay is not compensable. It is noticeable that there is a third type of delay, that the courts may intervene as a third party, to resolve the dispute between the client and the contractor, this delay could be due to more than one or several solidarity reasons at the same time. The final decision to indemnify the period shall be from the non-compensation of the jurisdiction of the competent courts and shall be binding on the parties to the dispute.

3. RESEARCH METHODOLOGY

Through a review of the literature, the objectives of this pre-defined research have been achieved, to understand and evaluate the perceptions of the main parties (clients, contractors, and consultants) in the construction process by studying the relative importance of these reasons and their impact on delaying implementation of PCPs in the Kurdistan region of Iraq, after studying Reflecting on the reasons for delaying construction through a review of the literature, the most important 45 factors causing delay in a project completion were studied, and categorized into four groups of factors:

The first group: It includes twelve factors (1-12) related to clients.

The second group: It includes ten factors (13-22) related to the consultant.

The third group: It includes fifteen factors (23-37) related to contractors.

Fourth group: It includes eight factors (38-45) related to external factors.

The questions were formulated taking advantage of the previous studies, taking into account the administrative and geographic privacy of the area under study, and presented it in an experimental way to an elite of engineers and university professors with experience in the field of construction, to ensure the achievement of the questionnaire goal, and to ensure clarity of questions by illuminating the less important questions. Thus, the final formulation of the questions was distributed to Engineers have worked in various major construction parties, whether with the client, contractor or consulting firms operating in the Kurdistan region of Iraq.

Figure (1): shows the percentage of the respondents for the different three categories (Contactor, Client, and Consultant).

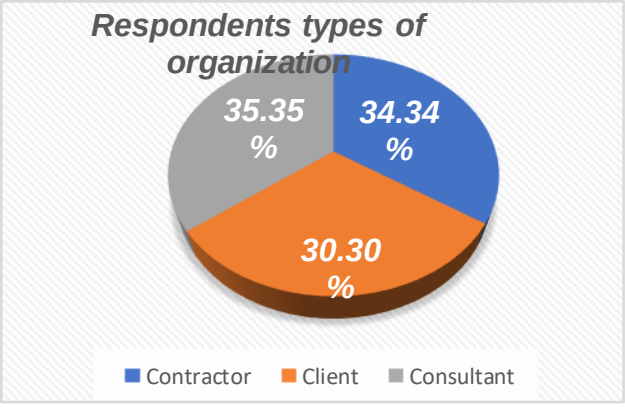

Fig. (1): Respondents types of organization

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Table 1. shows a high response rate from the respondents, in addition to the number of groups distributed from each of the parties participating in the questionnaire and the number of responses received. The collected data was analyzed through this survey using SPSS 10 statistics program.

Table (1): Percentage of questionnaire distributed and the responses received

Respondents	Questionnaire distributed	Received responses	Responses rate%
Contractor	**50**	**34**	**%68**
Client	**50**	**30**	**%60**
Consultant	**50**	**35**	**%70**
Total	**150**	**99**	**%66**

4. RELIABILITY OF THE QUESTIONNAIRE

To find out the reliability of the questionnaire, if the second time is presented to the participants, the same percentage of the answers are obtained. The value of Cronbach Alpha was calculated using the spss10 program to ensure the reliability of the questionnaire for both groups of variables. From the variables, summarize the results of the examination in the table below and according to (Rehan et al., 2015), (Al-Hammadi, 2016), (Prasad et al., 2019) and (Makesh, 2019), the results are considered acceptable if the values of the alpha is greater than 0.7, and therefore, the results of the reliability check can be considered as evidence of the reliability of the answers, standardized item alpha for frequency and impact index factors causing delay in construction projects are presented in Table 2.

Table (2): Alpha and standardized item alpha for frequency and impact index factors of delay

Variables	Alpha	Standardized item alpha
Frequency index of factors causing delay	**0.8172**	0.8160
Impact index for delaying factors	**0.8467**	0.8481

Frequency, impact and importance index for the data gathered in the survey, were found to analyze and understand the data, taking into consideration the perceptions of the parties participating in the questionnaire. Accordingly, the most important reasons for the delay were reached from the viewpoint of the three parties involved in the construction process in the Kurdistan region of Iraq through studying the index of frequency, impact and degree of importance. These three-index found through the statistical formulas as shown below:

1-Frequency Index: This formula is used to arrange the causes of the delay and the frequency of its occurrence in the responses of the survey participants. It is calculated by Equation (1);

$$(F.I)(\%) = \sum a\left(\frac{n}{N}\right) * \frac{100}{5} \quad (1)$$

2-Impact Index: This formula is used to rank the causes of the delay and according to the effect of its occurrence on the responses of the survey participants. It is calculated by Equation (2);

$$(IM.I)(\%) = \sum a\left(\frac{n}{N}\right) * 100/5 \quad (2)$$

3- The importance index: By knowing the frequency and impact index for each reason, the importance index for that reason can be calculated by Equation (3);

$$(IMP.I)(\%) = [(F.I)(\%) * (IM.I)(\%)]/100 \quad (3)$$

Where: (a) is the constant expressing weight given to each response ranged from (1 to 5).

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(n) is expressing the response frequency.

(N) is expressing the total number of responses.

The formulation of the questions was arranged in such a way that by answering the first set of questions, the competence, role, experience, type of projects implemented by the respondents and the amount of delay they faced could be known. As for the most important and second part of the questions, it was designed in order to know the opinion of the participants to show the reasons for the delay in the projects implemented by them and their occurrence and impact by choosing the number from (1 to 5),(1) ineffective ,(5) very effective.

5. EXPERIENCES OF THE RESPONDENTS

It is essential to know the average experiences of the participants in the survey process, 35% of the participants have an average experience of 15 years, while 27% of the participant have an average experience of 18 years, however, 38% of the participants have an average experience of 12 years as shown in Figure (2).

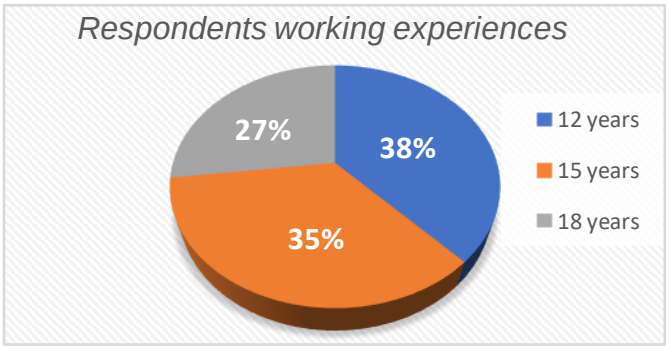

Fig. (2): Respondents working years of experiences

6. ANALYSIS OF THE RESULTS

The collected data from the survey were analyzed using the statistics program SPSS 10, the obtained results in terms of frequency, impact, and importance index for (12) factors related to the client, (10) factors related to the consultant, (15) factors related to the contractor, and (8) factors related to external factors are presented in the following tables:

Table 3 presents the ranking of 12 delay factors related to the client, the average of the most important client delay factors in terms of frequency, impact and importance are 52.36, 51.41 and 26.92, respectively. Top three ranked factors are: the frequent changes in the design by the client, Late payment of the contractor's monthly payments by the client, and inaccuracy in tender preparation by the owner with importance factors 70.20, 65.45, 44.38 respectively.

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Table (3): Ranking of sources of delay by the Client

SN	Client Delay Factors	Frequency Index (F.I)	Impact Index	Importance Index	Ranking
1	Changes of the design of the project.	81.97	85.64	70.20	1
2	Late payment of the contractor's monthly payments by the client.	78.74	83.12	65.45	2
3	Inaccuracy in tender preparation by the owner.	65.63	67.62	44.38	3
4	Owner's bureaucracy in handling contractor requests.	61.95	60.48	37.47	4
5	Luck of corporation between the owner from one side and the contractor or the consultant from the other side.	55.27	54.44	30.09	5
6	Unsatisfactory performance of the contractors with lowest bidding prices in the Kurdistan tendering system.	49.71	47.88	23.80	6
7	slow decision-making by the owner.	48.01	45.70	21.94	7
8	Luck of confidence between the contractor and the owner	44.87	40.28	18.07	8
9	unqualified Owner's supervisor staff.	41.68	38.12	15.89	9
10	Luck of seriousness in monitoring the project progress schedule char and its updates.	40.30	38.27	15.42	10
11	Delay in the delivery of the project site to the contractor.	35.99	33.07	11.90	11
12	Selectivity in dealing with the contractor's requests by the owner.	24.17	22.29	5.39	12
	Total average	52.36	51.41	26.92	

Table 4 shows the ranked ten factors related to consultants, the average of the consultant related factors in terms of frequency, impact and importance are 43.63, 43.51 and 18.98, respectively. Top three ranked factors are: changes in the project design by the consultant, Poor performance of the consultant engineer supervisor staff, and delay in issuing design documents with importance factors 45.03, 41.35, 37.29 respectively.

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Table (4): Ranking of consultant delay factors

SN	Consultant Delay Factors	Frequency Index (F.I)	Impact Index (IM.I)	Importance Index (IMP.I)	Ranking
13	Changes in the project design.	66.47	67.74	45.03	1
14	Poor performance of the consultant engineer supervisor staff.	63.52	65.09	41.35	2
15	Delay in issuing design documents.	61.98	60.17	37.29	3
16	Inactive presence of consultant's site staff.	59.68	60.47	36.09	4
17	Lack of boldness in decision-making	54.87	55.18	30.28	5
18	Drawings Deficiency.	48.29	48.39	23.37	6
19	Inaccuracy of contracting documents with design inconsistencies.	46.27	47.74	22.09	7
20	Inadequate coordination of the consultant.	44.89	45.78	20.55	8
21	Late instructions by the consultant.	41.01	38.18	15.66	9
22	Designers unfamiliarity of the site environment and conditions which lead to inadequate design of the project.	35.11	34.87	12.24	10
	Total average	43.63	43.51	18.98	

Table 5 shows the ranked fifteen factors related to the contractor, the average of the contractor related index factors in terms of frequency, impact and importance are 60.70, 60.07 and 36.46, respectively. Top three ranked factors are: Poor contractor cash flows, Poor project implementing planning, and Ineffective presence of the contractor on site with importance factors 70.78, 64.88, 62.45 respectively.

Table (5): Ranking of sources (groups) of delay by the Contractor

SN	Contractor Delay Factors	Frequency Index (F.I)	Impact Index (IM.I)	Importance Index (IMP.I)	Ranking
23	Poor contractor cash flows.	84.19	84.07	70.78	1
24	Poor project implementing planning.	82.12	79.01	64.88	2
25	Ineffective presence of the contractor in project site.	79.63	78.42	62.45	3
26	Lack of experience in project implementation by the contractor.	76.81	77.12	59.24	4
27	Subcontractors failure in fully comply with the project implementation instructions.	72.22	71.17	51.40	5
28	Poor communication between the main contractor and subcontractor.	69.07	68.78	47.51	6
29	Arguments between the main contractor and subcontractors.	64.87	65.18	42.28	7
30	Inadequate communication between the construction parties (contractor, client, consultant).	60.5	61.37	37.13	8
31	Construction material shortage.	58.29	57.46	33.49	9

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32	Inadequate project management by the contractor.	52.09	51.74	26.95	10
33	Ineligibility of the technical staff of the contractor in term of skills, experiences and qualifications.	48.11	46.63	22.43	11
34	Demolishes and rebuild due to mistakes and bad execution by the contractor.	44.89	45.78	20.55	12
35	Lack of modern equipment and machinery at the project site.	41.01	39.18	16.07	13
36	Delay in the field and laboratory tests.	39.11	40.07	15.67	14
37	Delay due to poor manpower productivity	37.55	35.08	13.17	15
	Total average	60.70	60.07	36.46	

Table 6 shows the ranked eight factors related to the external factors, the average of the external related index factors in terms of frequency, impact and importance are 51.87, 50.32 and 26.10, respectively. Top three ranked factors are: The effect of the hard weather conditions on construction different activities., Local and regional political instability, and Lack of cooperation between the three main parties (Client, Consultant, contractor) involved in the construction process with importance factors 50.24, 46.53, 35.27 respectively.

Table (6): Ranking of sources (groups) of delay by the external factors

SN	External Delay Factors	Frequency Index (F.I)	Impact Index (IM.I)	Importance Index (IMP.I)	Ranking
38	The effect of the hard weather conditions on construction different activities.	73.1	68.73	50.24	1
39	Local and regional political instability.	68.49	67.93	46.53	2
40	Lack of cooperation between the three main parties (Client, Consultant, contractor) involved in the construction process.	60.35	58.44	35.27	3
41	Bureaucracy and change of government regulations.	55.93	56.97	31.86	4
42	Change in material prices.	47.78	45.21	21.60	5
43	Unorganized official and informal holidays.	42.74	40.15	17.16	6
44	Global and local economic crisis.	35.32	34.98	12.35	7
45	Preventive and security measures.	31.25	30.14	9.42	8
	Total average	51.87	50.32	26.10	

It is important to include the effect of the four groups that cause delay in PCPs based on calculating the overall results for the averages of frequency, impact and importance indexes for each group of factors as shown in table 7. The results were arranged according to the degree of their importance, from the results it is evident that the factors related to the contractor are one of the most influencing factors on Project delay with a average important index of 36.46, followed by the factors related to the client in the second rank with average importance index of 26.92, in the third rank the impact of the set of factors related to external factors comes, with an average importance index of 26.10, and finally the impact of factors related to the consultant is locating in the bottom of the list with importance index of 18.98.

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Table (7): Delay factors groups classification according to the average importance index

Groups of delay factors	Average Frequency Index	Average Impact Index	Average Important Index	Ranking
Causes related to the contractor	60.70	60.07	36.46	1
Causes related to the client	52.36	51.41	26.92	2
Causes related to the external factors	51.87	50.32	26.10	3
Causes related to the consultant	43.63	43.51	18.98	4

In terms of importance index, table 8 classify all forty-five factors of delay, which selected to be under the scope of the current study, it illustrates that the most important three factors are: weak contractor cash flow, changes in project design by the client and late payment of the contractor's monthly payments by the client with importance index 70.78, 70.20, 65.45 respectively, from the classified factors, it could be concluded that out to ten top ranked factors, six factors are related to the contractor but only two factors are related to both client and external factors while the first consultant related factor, changes in the project design, ranked eleventh in the overall ranked delay factors with importance index of 45.03.

Table (8): Ranking of all causes of delay according to their importance index

Causes of delay	Cause no. in main list	group	Importance Index (IM.I)	Ranking
Poor contractor cash flows.	23	Contractor	70.78	1
Changes of the design of the project.	1	Client	70.20	2
Late payment of the contractor's monthly payments by the client.	2	Client	65.45	3
Poor project implementing planning.	24	Contractor	64.88	4
Ineffective presence of the contractor in project site.	25	Contractor	62.45	5
Lack of experience in project implementation by the contractor.	26	Contractor	59.24	6
Subcontractors failure in fully comply with the project implementation instructions.	27	Contractor	51.40	7
The effect of the hard weather conditions on construction different activities.	38	External	50.24	8
Poor communication between the main contractor and subcontractor.	28	Contractor	47.51	9
Local and regional political instability.	39	External	46.53	10
Changes in the project design.	13	Consultant	45.03	11
Inaccuracy in tender preparation by the owner	3	Client	44.38	12
Arguments between the main contractor and subcontractors.	29	Contractor	42.28	13
Poor performance of the consultant engineer supervisor staff.	14	Consultant	41.35	14
Owner’s bureaucracy in handling contractor requests.	4	Client	37.47	15
Delay in issuing design documents.	15	Consultant	37.29	16
Inadequate communication between the construction parties (contractor, client, consultant).	30	Contractor	37.13	17

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Inactive presence of consultant's site staff.	16	Consultant	36.09	18
Lack of cooperation between the three main parties (Client, Consultant, contractor) involved in the construction process.	40	External	35.27	19
Construction material shortage.	31	Contractor	33.49	20
Bureaucracy and change of government regulations.	41	External	31.86	21
Lack of boldness in decision-making	17	Consultant	30.28	22
Luck of corporation between the owner from one side and the contractor or the consultant from the other side.	5	Client	30.09	23
Inadequate project management by the contractor.	32	Contractor	26.95	24
Unsatisfactory performance of the contractors with lowest bidding prices in the Kurdistan tendering system.	6	Client	23.80	25
Drawings Deficiency.	18	Consultant	23.37	26
Ineligibility of the technical staff of the contractor in term of skills, experiences and qualifications.	33	Contractor	22.43	27
Inaccuracy of contracting documents with design inconsistencies.	19	Consultant	22.09	28
slow decision-making by the owner.	7	Client	21.94	29
Change in material prices.	42	External	21.60	30
Inadequate coordination of the consultant	20	Consultant	20.5506	31
Demolishes and rebuild due to mistakes and bad execution by the contractor.	34	Contractor	20.5506	32
Luck of confidence between the contractor and the owner	8	Client	18.07	33
Unorganized official and informal holidays.	43	External	17.16	34
Lack of modern equipment and machinery at the project site.	35	Contractor	16.07	35
unqualified Owner's supervisor staff.	9	Client	15.89	36
Delay in the field and laboratory tests.	36	Contractor	15.67	37
Late instructions by the consultant.	21	Consultant	15.66	38
Luck of seriousness in monitoring the project progress schedule char and its updates.	10	Client	15.42	39
Delay due to poor manpower productivity	37	Contractor	13.17	40
Global and local economic crisis.	44	External	12.35	41
Designers unfamiliarity of the site environment and conditions which lead to inadequate design of the project.	22	Consultant	12.24	42
Delay in the delivery of the project site to the contractor.	11	Client	11.90	43
Preventive and security measures.	45	External	9.42	44
Selectivity in dealing with the contractor's requests by the owner.	12	Client	5.39	45

7. IMPACT OF DELAY CAUSES ON THE PROJECT HANDOVER

Table 9 shows that projects handover significantly might be affected by the frequency occurrence of delays in the construction projects, factors associated with the contractor, the customer, external factors and consultant, affect time and cost overruns in projects implemented in the Kurdistan Region of Iraq with a high frequency index (65.12 and 52.05) for both time overruns and cost overruns respectively. It is

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worth noting that the contractor's poor cash flow factors and delaying the contractor's monthly payments may create problems and cause disputes that sometimes cause part of the work to be stopped or assigned until the court's decision, if the problem is not resolved amicably without resorting to the competent courts. The factors of the delay mentioned in table 9 could force the contractor to give up the project temporarily or permanently and may result in the company's bankruptcy with the inability to repay the loans with interest on the one hand and the infinite delay in the payment of financial dues for the contractor's work periodically, which results in the contractor having to resort to courts to resolve the dispute, as shown in table 9, frequency of occurrence of projects with disputes and arbitration is 37.68, whereas, it is 31.47 with litigation and 21.49 with total abandonment of project completion.

Table (9): impact of delay causes on the delivery of projects

Delay causes impact	Frequency of occurrence	Rank
Project time overrun	65.12	1
Project cost overrun	52.05	2
Disputes and arbitration	37.68	3
Litigation	31.47	4
Total abandonment of project completion	21.49	5

8. CONCLUSIONS

In this study according to the importance index severity all 45 delay factors have classified

Due to the administrative and organizational status of the Kurdistan region of Iraq, it has been excluded in many research and survey studies conducted in Iraq over a period of almost three decades, therefore, the objective of this research is to focus on the most important reasons for delaying the completion of PCPs in this region. After a thorough reviewing of the literature and studying of published researches in this regard, 45 causing delay factors were identified, including 12 factors related to the client, 15 factors related to the contractor, 10 factors related to the consultant, and 8 factors related to external factors. A questionnaire was conducted in the region with the participation of the three main parties involved in the construction industry (the client, the consultant and the contractor), responses were received from 34 contractors, 30 clients and 35 consultants, the impact of each factor was categorized through the use of frequency, impact and importance index after calculating the value of Cronbach Alpha Using the spss10 program.

The most important delay factors among the eight factors under study related to external factors are the effect of severe weather conditions, regional and local political instability, poor coordination between the three main parties, the bureaucratic in government dealings, and changing the laws and regulations. When analyzing the results of the delay factors related to the four groups from the viewpoint of the participants, it was found that the highest average importance index is for the factors related to the contractor (36.46), followed by factors related to the client and external factors with average importance index 26.92, 26.10 respectively, the second and third party influencing the delay of projects by a slight difference, while the fourth and least influential party from the viewpoint of the participants in the questionnaire is the consultant party with average importance index 18.98. After categorizing all four group delay factors together, it was found that seven up to top fifteen delay causes factors are related to the contractor and four related to the client, while only two factors related to both the consultant and the external

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factors. The survey classified the consequences of the delay in the implementation of public construction project according to the frequency index as follows: exceeding the required implementation time of the project , exceeding overcoming the cost of the project, disputes and arbitration, lawsuits and abandonment of the project in the courts with appearance frequency equal to 65.12, 52.05, 37.68, 31.47 and 21.49, respectively.

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