

Causes of Delay in Public Construction Projects in Iraq

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ABSTRACT

Construction industry is considered as one of the most important industries in Iraq. It is well known that most construction projects in this country are exposed to time and cost overrun or both.

The main objective of this study is to find the most important causes of delay in public projects in Iraq. This objective was achieved through an intensive literature review and a survey which included a questionnaire used to assess the perceptions of the main participants involved in the construction of the projects.

The questionnaire was divided into three parts. The main part focused on the causes of delay in construction sites. The 65 causes compiled through the literature review and the pilot study were classified into four groups (client related, contractor related, consultant related and external factors).

Answers were collected from 134 participants representing the three parties involved in the construction of the projects.

Analysis was carried out to find the amount of delay suffered by the projects, as well as the indices related to frequency of occurrence, severity and importance of the four groups. In addition, ranking of the 65 factors was carried out to identify the most crucial causes of delay.

It was concluded that the most effective delay factors affecting the time overrun in the public projects in Iraq are: security measures, government change of regulations and bureaucracy, official and non-official holidays, low performance of lowest bidder contractors in the government tendering system, design and changes by owner, design changes by consultants, delay in progress payments by the owner, problems with local community, owner's lack of experience in construction and economic local and global conditions.

KEYWORDS: Iraq, Government, Construction, Public projects, Delay, Time overrun.

INTRODUCTION

Delays occur in almost every construction project, and their effect on the performance of the project, might be very significant. In order to minimize or avoid these delays, it is important to identify their actual causes.

Construction delays can be defined in different ways. Bramble and Callahan (1987) have argued that "a delay is the time during which some part of the

construction project has been extended or not performed due to anticipated circumstances". Aibinu and Jagboro (2002) defined delay as a situation where contractor and project owner jointly or separately contribute to the non-completion of the project within the original or the stipulated or agreed contract period. According to Assaf and Al-Hejji (2006), delay was defined as "the time overruns either beyond the completion date specified in a contract or beyond the date that the parties agreed upon for the delivery of a project".

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Therefore, the delay in a construction project is time overrun or time extension beyond the agreed completion time.

OBJECTIVE

The main objective of this study is to identify the most important causes of delay in public construction projects in Iraq. This study identifies the causes of delay from the point of view of the three major parties involved in any construction project; namely, clients, consultants and contractors.

Scope of the Study

The study included projects in the middle and south of Iraq; all being public (government) construction projects. The northern region of Iraq (Kurdistan) had a considerable amount of stability for several years; while federal Iraq has suffered political and security difficulties over the past decade.

Classification of Delay

Delay in construction can be classified in different ways. Ahmed et al. (2003) classified delays into two groups. These are: internal causes and external causes. Internal causes arise from the parties to the contract. External causes arise from events beyond the contract of the parties.

Bolton (1990) classified delay as follows: 1. Excusable but non-compensable delays; these are delays caused by occurrences which are not attributable to any of the parties. 2. Compensable delays; these delays result from acts or omissions of the owner or someone for whose acts the owner is liable. 3. Inexcusable delays; these delays result from an own fault of the contractor, his subcontractors or material suppliers.

Delays can also be grouped into three types (Bramble and Callahan, 1987): 1. Excusable delays which occur for reasons beyond the contractor's control. These can be further divided into compensable and non-compensable delays. 2. Non-excusable delays;

these occur due to the contractor's weakness or not caused by the contractor but should be anticipated by the contractor under normal conditions. 3. Concurrent delays; these delays are due to the combination of two or more independent causes of delay during the same period. These delays may lead to disputes between the contractor and the client.

LITERATURE REVIEW

Many studies and papers have been published on the subject of causes of delay in building and civil engineering projects. These studies have been carried out internationally and in developing countries. As Iraq is one of the developing countries, more attention is given to the research work in these countries.

The study of Baldwin et al. (1971) was carried out to determine the causes of delay in the construction industry in the United States. Mansfield (1992) investigated the causes of delay and cost overruns that affect completed highway projects in Nigeria.

Assaf et al. (1995) studied the causes of delay in large building projects in Saudi Arabia and their importance. The researchers included (56) causes in their survey distributed over nine major groups. The survey included the clients, consultants and contractors. Also, Assaf and Al-Hejji (2006) conducted a time performance survey of different types of projects in Saudi Arabia to determine their importance according to each project participant (client, consultant and contractor). They identified (73) causes of delay during the study.

Al-Khalil and Al-Ghafly (1999) studied the delay in public water and sewage projects. Sixty (60) causes were identified and classified. Ogunlana et al. (1996) studied the delays in building projects in Thailand as an example of developing countries.

Mobarak (2004) studied the role of consultancy in minimizing the delays in large projects and showed possible categorizations of causes of delay such as internal and external, financial and non-financial. Construction delay problem in Egypt was studied by

Amer (1994) through the analysis of causes that contribute to construction delays in order to improve the ability to implement construction projects with minimum delay.

In Jordan, two studies were identified. Sweis et al. (2008) studied causes of delay in residential projects and concluded that financial difficulties faced by the contractor and the large amount of change orders by the client are the leading causes of construction delay. The second study, conducted by Al-Momani (2000), investigated the causes of delay in 130 public projects in Jordan which included residential, office and administration buildings, school buildings, medical centers and communication facilities. The study revealed that the most important delay causes in public buildings are related to: designer, client's changes, weather, site conditions, late deliveries, economic conditions and increase in quantity.

Kaming et al. (1997) studied the factors influencing (31) high rise buildings in Indonesia. The study found that the major factors causing delays are design changes, poor labor productivity, inadequate planning and resource shortages.

There are many other research works carried out in other developing countries. In Malaysia, two studies were sighted. Sambasvian and Soon (2007) identified the delay factors and their impacts on project completion. The results pointed to 10 out of 28 causes of delays. Among them are: poor contractor's planning and site management, client's inadequate financial resources and payments for completed works, problems with sub-contractors,... etc. A similar study by Alaghbari et al. (2007) identified (31) causes of delay. The study revealed that the most important causes are: financial problems and coordination problems.

Kumaraswamy et al. (1998) surveyed the causes of delay in Hong Kong. They found that there was a difference in perceptions as to causes of delay by different groups of participants in building and civil engineering works.

Two studies related to Saudi Arabia and Libya are taken as examples for developing countries. Shebob et

al. (2011) studied the impact of delay in Libyan construction projects by identifying and ranking the delay factors. The critical factors found in Libyan construction projects were: low skills of manpower, changes in the scope of the project, slowness in giving instructions,... etc. Statistical tests were run to test the significance of the data and found that the results were significant. Albogamy et al. (2012) studied the causes of delay in public building projects in Saudi Arabia with their relative importance. The survey conducted included 63 delay factors. The research revealed that the contractor related and owner/client related factors are the most critical factors that lead to delay the construction projects in Saudi Arabia.

RESEARCH METHODOLOGY

The objectives of the research defined earlier were achieved through a literature review and a survey. The survey included a questionnaire used to assess the perceptions of clients, contractors and consultants on the relative importance of causes and effects of delay in Iraqi construction industry. The questionnaire was divided into three parts. The first included general information about the respondents and their roles, experience and types of construction they are involved in, to explore the amount of delay they experienced. The second part, and the most important one, focused on causes of construction delay. The respondents were requested to indicate their response to the frequency of occurrence and degree of severity of 65 well-recognized construction delay factors. These causes were categorized into the following four groups of factors:

- Group 1: Client related factors, including 17 factors (factor 1 to factor 17).
- Group 2: Contractor related factors, including 25 factors (factor 18 to factor 42).
- Group 3: Consultant related factors, including 11 factors (factor 43 to factor 53).
- Group 4: External factors, including 12 factors (factor 54 to factor 65).

The third part of the questionnaire focused on the effects of construction delay on Iraqi construction industry. The six effects of delay identified were: time overrun, cost overrun, disputes, arbitration, litigation and abandonment of the project.

The form was designed for each cause of delay or effect on the project. The respondent score ranges from 1 to 5 depending on the frequency of occurrence and the severity of the cause or effect of delay on the project; as 1 for not effective and 5 to very effective.

The population of the study was based on construction parties (clients, contractors and consultants) in cities located in the middle and southern regions of Iraq. Cities in the northern region of Iraq were not included due to the fact that the government's regulations, security measures and conditions of work in these cities are considerably different.

Prior to the final formulation of the form, a pilot survey was conducted. The main purpose was to eliminate the less important questions and to check the clarity and feasibility assurance. The pilot study was carried out with the help of 10 engineers with an experience of more than 20 years. The form was revised in accordance of the notes received.

The forms were distributed to a wide range of engineering staff representing parties involved in the construction process (clients, consultants and contractors). Number of sets distributed and received is shown in Table (1).

Table 1. Number of questionnaire sets

	Clients	Consultants	Contractors	Total
Number distributed	100	100	100	300
Number received	44	48	45	134
Response rate	44%	48%	45%	45%

Data were gathered through the survey, analyzed using frequency, severity and importance indices,

taking in view the three parties mentioned. Recommendations for minimizing delay in construction projects were emphasized in view of the results of the survey.

DATA ANALYSIS

The collected data were analyzed through the following statistical techniques and indices:

Frequency Index: A formula is used to rank the causes of delay based on frequency of occurrence as identified by the participants.

$$\text{Frequency Index (F.I) (\%)} = \sum a (n/N) * 100/5. \quad (1)$$

Severity Index: A formula is used to rank the causes of delay based on severity as indicated by the participants.

$$\text{Severity Index (S.I) (\%)} = \sum a (n/N) * 100 / 5 \dots\dots (2)$$

Importance Index: The importance index of each cause is calculated as a function of both frequency and severity indices, as follows:

$$\text{Importance Index (I.I)(\%)} = [\text{F.I (\%)} * \text{S.I (\%)}] / 100.. (3)$$

where (a) is the constant expressing weight given to each response (range from 1 to 5), n is the frequency of the response and N is the total number of responses.

ANALYSIS OF RESULTS

General Information of the Participants

Respondents included 43 clients, 46 consultants and 45 contractors. These have an average experience of 17 years, 20 years and 18 years, respectively. The study covered only public sector projects. The participating clients included government ministries (Youth and Sport, Municipalities, Housing and Public Works, Justice, Governorate of Basra,... etc.). Contracting

companies, in general, included only high classified ones. Types of projects the participants are involved in are: sport facilities, public buildings, water supply, water treatment plants, housing complexes,... etc.

The majority of the respondents, about 48%, are Civil Engineers, while 17% and 12% are Project Managers and Architects, respectively. The other professions of the respondents were: Electrical Engineers, Mechanical Engineers,... etc.

Nature of business that respondents are involved in shows that the largest proportion of them, about 77%, are working in actual construction work. Also, 12% and 7% are working in engineering consultancy and provision of architectural engineering services respectively.

Most of the respondents hold a bachelor degree with those having postgraduate qualifications accounting for only 12% of the total number.

As observed above, about 65% of the respondents have an experience between 10 and 15 years. A cumulative total of 86% of the survey respondents have more than 10 years working experience.

Amount of Delays Suffered by the Projects

None of the 134 participants who contributed to the survey indicated that the projects experienced suffer no delay. Only about 2% of the participants indicated that there is a time overrun of less than 10% of the original time of the project. The other participants indicated that the percentages of project overrun are: more than 10% up to 30%, more than 30% up to 50%, more than 50% up to 70%, more than 70% up to 90% and more than 90%; with the corresponding percentages of the participants of: 13%, 18%, 27%, 20% and 11%, respectively. About 9% of the participants experienced project abandonment.

Client Related Delay Factors

There were 17 client related factors included in the questionnaire. Table (2) presents the results based on frequency, severity and importance indices. The most

crucial delay factor related to client is "low performance of the lowest bidder contractors in the Iraqi government tendering system". This factor was ranked at the first place due to an important index rate of 38.63 (63.13 for frequency index and 61.19 for severity index). The other important key factors related to the client which are causing delay problems are: design changes by the owner, delay in progress payments by the owner, owner's lack of experience in construction and poor qualification of supervision staff of the owner's engineer. The respondents believe that "difficulties in obtaining work permits from the authorities" is the least influencing factor in this category causing delays with an importance index of 21.20.

The averages of the group indices related to frequency, severity and importance are: 54.92, 53.94 and 29.62, respectively.

Contractor Related Delay Factors

The contractor related factors considered were 25 delay factors included in the survey. Table (3) shows the results of each factor based on frequency, severity and importance indices. Delay caused by "Poor qualification, skills and experience of the contractor's technical staff" ranks first with frequency, severity and importance indices of 55.22, 52.54 and 29.01, respectively. The next seven causes of delay according to their respective importance indices are: Poor controlling of subcontractors by contractor (relationships, payments...), cash flow problems faced by the contractor, slow preparation of change order requests by the contractor, poor planning and scheduling of the project by the contractor, poor site management and supervision by the contractor, improper construction methods implemented by the contractor and material quality problems. The averages of the group indices related to frequency, severity and importance are: 47.34, 47.50 and 22.49, respectively.

Table 2. Ranking of sources (groups) of delay by the clients

Sources (groups) of delay	Frequency of Occurrence		Severity		Importance	
	Index	Rank	Index	Rank	Index	Rank
Low performance of the lowest bidder contractors in the Iraqi government tendering system	63.13	1	61.19	1	38.63	1
Design changes by the owner	62.54	2	60.00	2	37.54	2
Delay in progress payments by the owner	60.00	4	58.66	3	35.20	3
Owners' lack of experience in construction	60.30	3	56.87	4	34.29	4
Poor qualification of supervision staff of the owner's engineer	56.42	8	56.57	5	31.92	5
Uncooperative owner with the contractor or consultant	57.46	6	55.22	7	31.73	6
Lack of coordination with contractors	57.46	5	53.88	9	30.96	7
Inadequate early planning of the project	56.57	7	54.33	8	30.73	8
Breach or modification of contract by the owner	55.37	10	55.22	6	30.58	9
Delay in the approval of the contractor submittals to the owner	55.67	9	53.73	10	29.91	10
Insufficient available utilities on site	53.73	11	52.99	12	28.47	11
Contract duration to construction of project is too short	52.54	13	53.58	11	28.15	12
Slow decision making process of the owner	52.54	12	50.75	14	26.66	13
Mistakes in soil investigation	50.30	14	52.69	13	26.50	14
Changes in the scope of the project	47.91	15	48.66	15	23.31	15
Delay in delivering the site to the contractor	45.07	17	47.31	16	21.32	16
Difficulties in obtaining work permits from the authorities	46.57	16	45.52	17	21.20	17

Table 3. Ranking of sources (groups) of delay by the contractors

Sources (groups) of delay	Frequency of Occurrence		Severity		Importance	
	Index	Rank	Index	Rank	Index	Rank
Poor qualification, skills and experience of the contractor's technical staff	55.22	1	52.54	1	29.01	1
Poor controlling of subcontractors by contractor (relationships, payments...)	52.84	4	51.94	5	27.44	2
Cash flow problems faced by the contractor	51.19	7	52.99	2	27.13	3
Slow preparation of change order requests by the contractor	53.28	3	50.75	6	27.04	4
Poor planning and scheduling of the project by the contractor	51.64	5	52.09	3	26.90	5
Poor site management and supervision by the contractor	51.49	6	52.09	4	26.82	6
Improper construction methods implemented by the contractor	54.18	2	50.75	7	26.59	7
Material quality problems	49.70	9	50.15	8	24.93	8
Delay in site mobilization	50.12	8	49.06	10	24.59	9
Shortage of construction material	47.46	10	48.21	11	22.88	10
Equipment availability and failure	46.42	11	49.25	9	22.86	11
Delay in preparation of shop drawings	45.67	16	47.31	12	21.61	12
Delay of material supply	45.82	14	47.01	13	21.54	13
Difficulties in obtaining work permits from the authorities concerned	46.42	12	45.97	16	21.34	14
Poor manpower productivity	45.82	15	46.12	15	21.13	15
Shortage of qualified engineers	45.97	13	45.97	17	21.13	16
Delay due to sub-contractor work	45.07	17	46.27	14	20.86	17
High number of contractor by the same contractor	43.88	21	45.97	18	20.17	18
Poor communication by the contractor with the parties involved in the project	44.48	19	45.07	20	20.05	19
Delay in the preparation of contractor document submissions	42.69	23	45.97	19	19.62	20
Mistakes and rework due to errors during construction by the contractor	44.03	20	44.48	21	19.58	21
Breach of contract by the contractor	43.58	22	43.73	22	19.05	22
Delay in test samples of materials	42.24	24	43.43	23	18.34	23
Shortage in equipment availability	44.63	18	39.1	25	17.44	24
Technical problems in project site by the contractor	39.70	25	41.34	24	16.41	25

Delay Factors Caused by the Consultant

The survey included 11 delay factors related to the consultant. Table (4) shows the results of each factor based on frequency, severity and importance indices. Delay due to “design changes” is the most crucial factor with indices of 61.64, 60.45 and 37.26, respectively. The next five delay causes according to their importance indices are: inadequate qualification of the consultant to the project, deficiency in drawings,

poor qualification of supervision staff of the consultant engineer, absence of consultant’s site staff and delay in giving instructions. The least important factor within this group is “design errors and discrepancies in contract documents” with an importance index of 19.92. The averages of the group indices related to frequency, severity and importance are: 50.58, 50.27 and 25.43, respectively.

Table 4. Ranking of sources (groups) of delay by the consultants

Sources (groups) of delay	Frequency of Occurrence		Severity		Importance	
	Index	Rank	Index	Rank	Index	Rank
Design changes	61.64	1	60.45	1	37.26	1
Inadequate qualification of the consultant to the project	56.27	2	55.22	2	31.07	2
Deficiency in drawings	55.22	3	54.63	3	30.17	3
Poor qualification of supervision staff of the consultant engineer	51.64	4	49.10	5	25.36	4
Absence of consultant’s site staff	50.00	6	49.40	4	24.70	5
Delay in giving instructions	50.45	5	48.66	7	24.55	6
Delay in approval of shop drawings	47.61	7	48.66	8	23.16	7
Design errors made by the designers due to unfamiliarity with local conditions and environment	47.31	8	48.81	6	23.09	8
Poor communication and coordination by the consultant engineer	46.12	9	46.57	10	21.47	9
Documents not issued on time	45.22	10	47.16	9	21.33	10
Design errors and discrepancies in contract documents	44.93	11	44.33	11	19.92	11

Delay Causes Due to External Factors

There were 12 external factors included in the questionnaire. Table (5) shows the results of the study based on frequency, severity and importance indices. It was found that “security measures” is the most important factor with relatively high indices of 76.87, 75.07 and 57.70. The second most important factor is “government change of regulations and bureaucracy

with, also, relatively high indices of 69.55, 69.55 and 48.37. The next most effective factors are: official and non-official holidays, problems with local community, economic conditions; local and global and lack of communication between different parties. The averages of the group indices related to frequency, severity and importance are 56.14, 55.95 and 31.34, respectively.

Table 5. Ranking of sources (groups) of delay by the external factors

Sources (groups) of delay	Frequency of Occurrence		Severity		Importance	
	Index	Rank	Index	Rank	Index	Rank
Security measures	76.87	1	75.07	1	57.70	1
Government change of regulations and bureaucracy	69.55	2	69.55	2	48.37	2
Official and non-official holidays	63.28	3	67.46	3	42.69	3
Problems with local community	54.33	5	63.13	4	34.30	4
Economic conditions; local or global	58.51	4	54.78	5	32.05	5
Lack of communication between different parties	50.30	6	50.60	6	25.45	6
Unforeseen site conditions and geological factors	48.36	8	50.15	7	24.25	7
Rise in the prices of materials	48.66	7	49.25	8	23.96	8
Delays in resolving contractual issues	43.43	12	52.99	9	23.02	9
Conflict between contractor, owner and consultant	47.91	9	46.27	10	22.17	10
Weather conditions effect on construction activities	46.57	11	46.12	11	21.48	11
External work due to public agencies (roads, utilities and public services).	46.72	10	45.97	12	21.47	12

Analysis of Overall Results by Delay Cause Groups

The groups of delay causes were analyzed based on the overall results. The group frequency, severity and importance indices were calculated as the averages of

indices for the related delay factors in the group. The ranked groups of delay causes and their corresponding frequency, severity and importance indices are shown in Table (6).

Table 6. Ranking according to group

Rank	Group of Delay	Frequency Index	Severity Index	Importance Index
1	External causes	56.14	55.95	31.41
2	Client related causes	54.92	53.94	29.62
3	Consultant related causes	50.58	50.27	25.43
4	Contractor related causes	47.34	47.50	22.49

Overall Delay Cause Ranking

Table (7) shows the ranking of the 65 causes of

delay without classifying them in any category. It was found that the top 10 factors causing delay are: (1)

security measures, (2) government change of regulations and bureaucracy, (3) official and non-official holidays, (4) low performance of the lowest bidder contractors in the government tendering system, (5) design changes by the owner, (6) design changes

by the consultant, (7) delay in progress payments by the owner, (8) problems with local community, (9) owner's lack of experience in construction and (10) economic conditions; local and global.

Table 7. Ranking of all causes of delay according to their importance index

Cause of Delay	Cause no. on main list	Importance Index	Group
Security measures	60	57.70	External
Government change of regulations and bureaucracy	62	48.37	External
Official and non-official holidays	65	42.69	External
Low performance of the lowest bidder contractors in the government tendering system	15	38.63	Clients
Design changes by the owner	11	37.54	Clients
Design changes by the consultant	46	37.26	Consultants
Delay in progress payments by the owner	4	35.20	Clients
Problems with local community	58	34.30	External
Owners' lack of experience in construction	2	34.29	Clients
Economic conditions; local or global	54	32.05	External
Poor qualification of supervision staff of the owner's engineer	13	31.92	Clients
Uncooperative owner with the contractor or the consultant	12	31.73	Clients
Inadequate qualification of the consultant to the project	43	31.07	Consultants
Lack of coordination with contractor	9	30.96	Clients
Inadequate early planning of the project	1	30.73	Clients
Breach or modification of contract by the owner	10	30.58	Clients
Deficiency in drawings	48	30.17	Consultants
Poor qualification, skills and experience of the contractor's technical staff	19	29.91	Contractors
Delay in the approval of contractor submittals to the owner	6	29.01	Clients
Insufficient available utilities on site	17	28.47	Clients
Contract duration to construction of project is too short	8	28.15	Clients
Poor controlling of subcontractors by the contractor (relationships, payments...)	29	27.44	Contractors
Cash flow problems faced by the contractor	22	27.13	Contractors
Slow preparation of change order requests by the contractor	26	27.04	Contractors
Poor planning and scheduling of the project by the contractor	18	26.90	Contractors
Poor site management and supervision by the contractor	27	26.82	Contractors
Slow decision making process by the owner	5	26.66	Clients
Improper construction methods implemented by the contractor	41	26.59	Contractors
Mistakes in soil investigation	16	26.50	Clients
Weather conditions effect on construction activities	55	25.45	External

Poor qualification of supervision staff of the consultant engineer	51	25.36	Consultants
Material quality problems	38	24.93	Contractors
Absence of consultant's site staff	45	24.70	Consultants
Delay in site mobilization	42	24.59	Contractors
Delay in giving instructions	52	24.55	Consultants
Unforeseen site conditions and geological factors	56	24.25	External
Rise in the prices of materials	61	23.96	External
Changes in the scope of the project	7	23.31	Clients
Delay in approval of shop drawings	44	23.16	Consultants
Design errors made by designers due to unfamiliarity with local conditions and environment	53	23.09	Consultants
Delays in resolving contractual issues	59	23.02	External
Shortage of construction material	39	22.88	Contractors
Equipment availability and failure	20	22.86	Contractors
The conflict between contractor, owner and consultant	63	22.17	External
Inadequate qualification of the consultant to the project	34	21.61	Consultants
Delay of material supply	37	21.54	Contractors
Weather conditions effect on construction activities	57	21.48	External
Poor communication and coordination by the consultant engineer	50	21.47	Consultants
External work due to public agencies (roads, utilities and public services).	64	21.47	External
Difficulties in obtaining work permits from the authorities concerned	21	21.34	Contractors
Documents not issued on time	49	21.33	Consultants
Delay in delivering the site to the contractor	3	21.32	Clients
Difficulties in obtaining work permits from the authorities	14	21.20	Clients
Poor manpower productivity	35	21.13	Contractors
Shortage of qualified engineers	32	21.13	Contractors
Delays due to sub-contractor work	24	20.86	Contractors
High number of contracts by the same contractor	33	20.17	Contractors
Poor communication by the contractor with the parties involved in the project	25	20.05	Contractors
Design errors and discrepancies in contract documents	47	19.92	Consultants
Delay in the preparation of contractor document submissions	23	19.62	Contractors
Mistakes and rework due to errors during construction by the contractor	28	19.58	Contractors
Breach of contract by the contractor	31	19.05	Contractors
Delay in test samples of materials	40	18.34	Contractors
Shortage in equipment availability	36	17.44	Contractors
Technical problems in project site by the contractor	30	16.41	Contractors

Effect of Delay on Project Delivery

Table (8) shows the frequency of occurrence of the effects of construction delays on project delivery revealed by the field study.

Table 8. Effect of delay on project delivery

Cause of delay	Rank	Frequency of occurrence
Time overrun	1	94.62
Cost overrun	2	88.50
Disputes	3	73.37
Arbitration	4	64.33
Total abandonment	5	58.21
Litigation	6	55.67

Below are general discussions of the effect of delay on project delivery.

Time and Cost Overrun

External factors and client related factors have impact on the time and cost overrun. Out of ten most important causes of delay discussed, nine causes belong to external factors and client related ones. Factors such as: security measures, government change of regulations and bureaucracy, official and non-official holidays, low performance of the lowest bidder contractors in the government tendering system, design changes by the owner; affect the completion of the project and cause time overrun.

Disputes and Arbitration

The above mentioned factors have impact on the disputes that arise during the course of the project. Factors such as: delay in the payments for completed works, frequent design changes by the client or consultant, problems with the local community; give rise to disputes which if not solved amicably can lead to arbitration.

Total Abandonment

The above mentioned factors contribute to the total

abandonment of the project. In Iraq, many projects were temporarily or permanently abandoned during the political crisis between 2003 and 2014.

Litigation

Again, the above mentioned factors escalate disputes to be settled by litigation process. The parties involved in the project use litigation as a last resort to settle disputes.

CONCLUSIONS

The objectives of this research were to identify the main causes of delay that affect public works in Iraq. A literature review was conducted to identify the causes of delay stipulated in the literature. Through the literature review and the pilot study, 65 causes of delay were identified and combined into four groups. These are: client related, contractor related, consultant related and external delay factors.

Three major stakeholders, including 43 clients, 46 consultants and 45 contractors responded to the questionnaire. The frequency, severity and importance indices were used to rank the effect of each cause of delay.

The participants in the survey agreed that the projects they experienced suffer considerable amount of delay and that projects in many cases get temporarily or permanently abandoned.

The survey revealed that the main causes of delay related to the client are: low performance of the lowest bidder contractors in the Iraqi government tendering system, design changes by the client and delay in progress payments by the client. Details of the results related to client are shown in Table (2). In addition, the main causes of delay related to contractors are: poor qualification, skills and experience of the contractor's technical staff, poor controlling of subcontractors by the contractor and cash flow problems faced by the contractor. Table (3) shows all the details and ranking of the 25 factors related to contractors. As far as delay factors are caused by the consultant, the study revealed

that out of 11 causes the most effective are: design changes, inadequate qualification of the consultant to the project and deficiency in drawings. Table (4) shows all the details related to this group. The fourth group included in the study has to do with causes of delay related to external factors. Table (5) shows the most effective factors. These are: security measures, government regulations and bureaucracy and official and non-official holidays.

In analyzing the delay factors from the point of view of the construction participants, the highest mean average (31.41) in Table (6) shows that a large number of delays is occurring due to external factors. The second highest mean average (29.62) of delay factors is representing the owner as the second most influencing construction party causing delays. Consultant and contractor were having the least mean averages of (25.43) and (22.49), respectively.

The ranking of overall causes of delay (Table 7) showed that the most important causes identified by the survey are: security measures, government change of

regulations and bureaucracy, official and non-official holidays, low performance of lowest bidder contractors in the government tendering system and changes by owners and consultants. It can be noticed that among the first ten causes of delay identified, there are 5 causes related to external factors. These are: the first three causes just mentioned, in addition to problems with local community and economic conditions; local and global.

The survey revealed that the delay of project will cause time overrun, cost overrun, disputes, arbitration, total abandonment and litigation. The frequency of occurrence is shown in Table (8).

The interviews revealed that in Iraq, many projects were temporarily or permanently abandoned during the years 2003-2014. Promoters of various projects backed out because of poor security and poor relationship with the local community. Even for some contracts, the client could not handover the project's site to the contractor because the site was occupied by local people.

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