International Journal of Architectural, Civil and Construction Sciences
ISSN: 2415-1734
Vol:10, No:4, 2016

Causes of Construction Delays in Qatar Construction Projects

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***Abstract*—**Construction industry mainly focuses on the superstructure, infrastructure, and oil and gas industry. The development of infrastructure projects in developing countries attracted a lot of foreign construction contractors, consultants, suppliers and diversified workforce to interfere and to be evolved in such huge investment. Reducing worksite delays in such projects require knowledge and attention. Therefore, it is important to identify the influencing delay attributes affecting construction projects. The significant project factors affecting construction delays were investigated. Data collection was carried out through an online web survey system to capture significant factors. Significant factors were determined with importance index and relevant recommendations are made. The output of the data analysis would lead the industry experts better assess the impact of construction delays on construction projects.

***Keywords*—**Construction industry, delays, importance index.

I. Introduction

NUMEROUS studies and researches contributed in defining the concept of construction delay. According to research, construction delay could be referred to as not achieving desired project duration upon contract agreement [1]. Or it could be considered as an unforeseen uncertainty in the construction phase of projects [2], [3]. Another research defined delays as challenges during projects execution [4].

According to many studies, there is always a need in each developing country to explore, identify and examine causes of delays in construction; it was found that 70% of construction projects failed to meet planned completion date in KSA [5]. Others stated that delays are almost occurring in most of construction projects although effect of each delay varies from project to project [3].

The main objective of the project is to identify major delay attributes affecting construction projects. Data were accumulated using an online survey to measure the differences and significance of the attributes according to industry experts. These results of the data analysis can be used to help owners, international contractors, and many other construction stakeholders to reduce the impact of delays on the construction sites.

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II. Research Methodology

The methodology followed in this paper will be presented. Fig. 1 illustrates the systematic process used in this research. This study has adopted qualitative research technique by first; establishing a draft list of 83 delay factors collected from literature review, the number of factors was revised based on discussions with industry experts and a recommendation of 42 factors were taken into account in the study. To identify the influence of delay factors affecting the construction industry, a quantitative procedure was adopted by developing a survey questionnaire, and applying analysis to the survey data using statistical methods, which will be discussed in the sections below.

Fig. 1 Project methodology process

In order to gather the necessary data required to conduct data analysis, survey questionnaire approach was adopted as a means of gathering required information. Research conducted aiming to investigate perceptions of the respondents on the influencing delay attributes prevailing in the construction industry. A ranking comparison was applied between respondents based on their location, organization type, job designation, industry type, total construction experience, and based on size of the company they represent. For a convenient method of distribution, the questionnaire was designed to be run through website.

The survey is composed of two sections:

1) Participants information, which would help in categorizing the respondents into different groups for the purpose of comparisons.
2) Evaluation of delay factors by respondents. This section is composed of 42 delay factors affecting construction projects identified from literature search.

The respondents were requested to evaluate the attributes based on a 5 point Likert Scale (1=Very Low, 2=Low, 3=Moderate, 4= high, 5=Very High):

- Importance (the delay impact on construction project) and;
- Frequency (How often the attribute is implemented or considered).

For an example, for the first Cause of Delay factors" Delay in decision making", the respondent was asked to evaluate the:

- Importance: What is the impact of "Delay in decision making" on construction projects?
- Frequency: How often is "Delay in decision making "considered or does it occurs in construction projects?

The survey was sent to several contacts that play key roles in the construction industry. A total of 179 completed surveys were received. According to [6], 151 survey sample size is the required sample size to satisfy 7.5% margin of error, and a confidence level of 95%, with an unknown or huge population size number and unknown percentage of response.

One of the concerning aspects when a research is developed based on Likert Scale survey questionnaire data is internal consistency of the questionnaire, so in order to measure internal consistency, a recommended approach by various researchers, Cronbach's Alpha coefficient of reliability will be applied [7]. Cronbach's Alpha coefficient is actually used in this search aiming to confirm that the criterion associated with Likert Scale actually measures the hypothesis, which is importance and frequency of delay attributes in the construction industry), that were aimed to measure. Values of Cronbach Alpha fall between 0 and 1. "A value of 0.7 is considered to be acceptable and 0.8 or higher indicates good internal consistency" [7]. With the help of Statistical Package for social sciences (SPSS v.20) Cronbach Alpha value for the survey data was obtained, coefficient value of ***0.932*** which was found for the study showing a high consistency.

III. Importance Index

The Relative Importance Index (RII) and (FI) [1] were chosen to assess and rank each delay attribute importance based on responses scores collected from the survey. Gunduz et al. [1] used the relative importance index to analyze factors that delays Turkish construction projects. It was also implemented by many others as it was earlier discussed in literature review. 5 point Likert Scale was applied to rate the importance of the attributes and Relative Importance Index was applied using:

$$RII=(\sum w)/(A(N)) \quad (1)$$

where, W = weight given to each attribute by the respondent (1 to 5). A = the highest weight (in this case is 5). N = total number of respondents

The value of the RII ranges from 0 to 1, a higher value indicates that the attribute is more significant compared to others.

A similar yet inventive ranking approach adopted in this research to rank delay attributes in construction industry is the Frequency Index (FI). FI values will be calculated based on:

$$FI\%=(\sum w)x100/(A(N)) \quad (2)$$

where, W = weight given to each factor by the respondents (1 to 5). A = the highest weight (in this case is 5). N = total number of responses.

IV. Data Demographics

Fig. 2 shows location of the respondents, as well as it shows the actual number of survey participants. Participants from Qatar represents majority of the respondents constituting 85.5% of the total numbers. The rest of participants represent a number of 26 equivalents to 14.5% of individuals from other parts of the world such as GCC, Palestine, Turkey, Iraq, Iran, India, Azerbaijan, and USA.

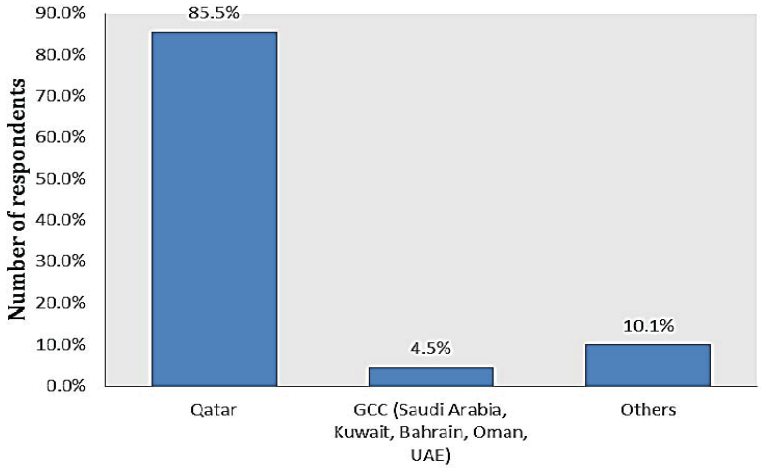

Fig. 2 Number of respondents based on location

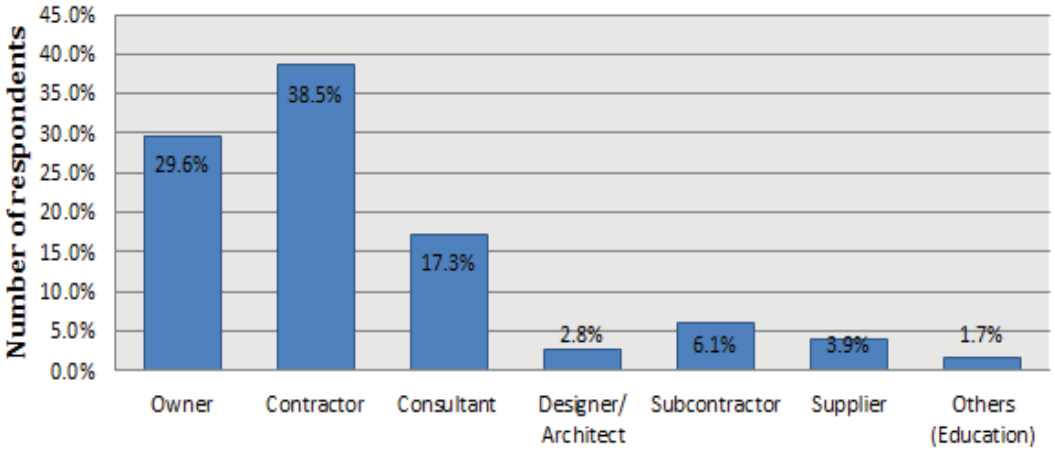

Fig. 3 Number of respondents based on Organization type

The participant from various organizations represents various fields that are related to construction, such as owner, contractor consultant, designers, subcontractors, suppliers, and others (education, etc.). Contractors are the largest portion of respondents with 69 numbers of responses. Owners, the second largest contributors of the survey form almost 30% of the total participants. Third large number of contribution with 31 responses is the consultants who are involved with firms specialized in construction consulting services. The numbers of respondents based on organization type are shown in Fig. 3.

V. Factor Rankings

Table I shows both RII values and ranking of delay attributes developed based on importance scale values by responses from all the participants. The values were calculated using Relative importance index (RII) as (1).

From Table I, it was found that the top 5 ranked delay factors based on RII values are as follows:

1. Delay in decision making (Delays related to owner or owner representative).
2. Poor site management and supervision (Delays related to Contractor).
3. Shortage of construction materials (Delays related to material).
4. Changes to the project by owner (Delays related to owner or owner representative).
5. Shortage of labors (Delays related to Labor).

Frequency of delay attributes in construction projects are represented in Table II, as per the responses from all the participants. FI (1)-FI equation was used to come up with the FI values.

From Table II, it was found that the top 5 ranked delay factors based on FI values are as follows:

1. Low productivity of labor (Delays related to Labor).
2. Delays related to sub-contractors work (Delays related to Contractor).
3. Changes to the project by owner (Delays related to owner or owner representative).
4. Delay in revising and approving documents (design, shop drawings, submittals. etc.) by owner (Delays related to owner or owner representative).
5. Unqualified workforce (Delays related to Labor).

VI. Conclusion

The objective of this paper is to identify the most influential delay attributes affecting the construction industry. After a review of past literature, a list of 42 delay attributes was produced and presented in a questionnaire survey. The survey was distributed to various experts in the field of construction industry. 179 respondents evaluated the 42 delay attributes based on importance (the delay impact on construction project).

The significance of this research is that its outcomes can easily be assessed by the construction industry professionals.

The work presented in this project can be improved further by a) Conducting more interviews or face-to-face interviews with more respondents. b) Expanding the data set by distributing the survey to more professionals with various backgrounds and different industry experiences from Qatar, GCC, and rest of the world. c) Conducting comparison study of most influential delay attributes affecting the construction industry between developing countries and developed countries. d) Increase the number of delay attributes. e) By conducting case studies on real construction projects. f) Developing a framework for assessing the delays in current projects in Qatar.

TABLE I
RII VALUES AND RANKING OF DELAY ATTRIBUTES BY ALL RESPONDENTS

Delays related to owner or owner representative	RII%	RI rank
Delay in decision making	85.00	1
Suspension of work	74.30	11
Delay in revising and approving documents (design, shop drawings, submittals. etc.) by owner	70.90	20
Delay in delivering construction site to contractor	64.50	29
Delay of financing and payments by owner	74.20	12
Changes to the project by owner	78.40	4
Type of project bidding and award	53.20	42
Unrealistic enforced contract duration	71.50	18
Lack of experience of owner (or owner representative) in construction projects	69.50	23
Delay by owner in handing over process or approval of completed work	64.80	28
Delays related to Consultants		
lack of experience of consultants	71.50	18
Delay in approval of submittals, design drawings, shop drawings, and sample materials, etc.	75.00	9
Mistakes or discrepancies in documents or specifications issued by consultants	66.40	26
Poor communication and coordination with other parties	73.60	13
Delay in inspection	62.50	32
Delays related to Contractor		
Difficulties in financing the project by contractor	73.40	15
Poor site management and supervision	80.80	2
Deficiency in planning and scheduling of project	74.60	10
Rework due to errors during construction	65.50	27
Delays related to sub-contractors work	73.60	13
Lack of experience of contractor (Poor qualification of contractors' staff)	70.40	22
Inappropriate construction methods	59.30	38
Poor communication and coordination with other parties	68.90	24
Unsafe practice at site (Poor safety conditions on site)	61.50	34
Delays related to Material		
Shortage of construction materials	80.40	3
Delays due to material delivery	77.40	6
Changes in material types and specifications during construction	72.10	17
Inflation and escalation of material prices	61.20	35
Delays related to Labor		
Shortage of labors	77.80	5
Unqualified workforce	75.40	8
Low productivity of labor	77.10	7
Delays related to Construction site		
Shortage of equipment and/or equipment failure	70.50	21
Unforeseen site conditions (Unexpected subsurface conditions e.g. soil, high water table, etc.)	72.40	16
Restriction at job site (Poor site access, traffic congestion)	60.90	36
Lack of site utilities or services such as (water, electricity, etc.)	58.90	39
Accident during construction	63.90	31
Problem with nearby structure or facilities (Disturbance to public activities, effect of social and cultural factors)	55.50	41
Delays related to External		
Weather effect (heat, rain, etc.)	64.10	30
Changes in government regulations and laws	58.40	40
Delay in performing final inspection and certification by a third party	61.60	33
Global financial crisis	60.60	37
Force Majeure (earthquake, etc.)	68.90	24

TABLE II
FI VALUES AND RANKING OF DELAY ATTRIBUTES BY ALL RESPONDENTS

Delays related to owner or owner representative	FI%	FI rank
Delay in decision making	66.15	6
Suspension of work	42.68	36
Delay in revising and approving documents (design, shop drawings, submittals. etc.) by owner	67.15	4
Delay in delivering construction site to contractor	45.03	34
Delay of financing and payments by owner	54.19	25
Changes to the project by owner	67.26	3
Type of project bidding and award	43.58	35
Unrealistic enforced contract duration	59.22	16
Lack of experience of owner (or owner representative) in construction projects	54.53	24
Delay by owner in handing over process or approval of completed work	60.89	13
Delays related to Consultants		
lack of experience of consultants	52.85	27
Delay in approval of submittals, design drawings, shop drawings, and sample materials, etc.	63.58	8
Mistakes or discrepancies in documents or specifications issued by consultants	57.88	18
Poor communication and coordination with other parties	64.36	7
Delay in inspection	51.28	30
Delays related to Contractor		
Difficulties in financing the project by contractor	57.09	19
Poor site management and supervision	61.79	11
Deficiency in planning and scheduling of project	61.90	10
Rework due to errors during construction	56.20	22
Delays related to sub-contractors work	69.50	2
Lack of experience of contractor (Poor qualification of contractors' staff)	58.32	17
Inappropriate construction methods	49.50	31
Poor communication and coordination with other parties	60.78	14
Unsafe practice at site (Poor safety conditions on site)	56.54	20
Delays related to Material		
Shortage of construction materials	61.79	11
Delays due to material delivery	62.57	9
Changes in material types and specifications during construction	56.54	20
Inflation and escalation of material prices	54.64	23
Delays related to Labor		
Shortage of labors	59.33	15
Unqualified workforce	66.48	5
Low productivity of labor	75.08	1
Delays related to Construction site		
Shortage of equipment and/or equipment failure	52.85	27
Unforeseen site conditions (Unexpected subsurface conditions e.g. soil, high water table, etc.)	48.16	33
Restriction at job site (Poor site access, traffic congestion)	53.18	26
Lack of site utilities or services such as (water, electricity, etc.)	42.12	38
Accident during construction	39.89	39
Problem with nearby structure or facilities (Disturbance to public activities, effect of social and cultural factors)	42.57	37
Delays related to External		
Weather effect (heat, rain, etc.)	51.73	29
Changes in government regulations and laws	39.55	40
Delay in performing final inspection and certification by a third party	49.39	32
Global financial crisis	38.21	41
Force Majeure (earthquake, etc.)	30.28	42

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