AN INVESTIGATION OF CAUSES OF DELAY AFFECTING THE UNITED ARAB EMIRATES CONSTRUCTION INDUSTRY

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Abstract - The construction industry has a major impact on the emerging economy of a developing country. A common problem affecting the delivery of projects (private or public) is delay, which has a significant negative effect not only on the local state (Emirate) but on the UAE economy as a whole. The purpose of this paper is to determine the critical delay factors that affect UAE industry. This was achieved by a deep study of the literature and by carrying out a questionnaire survey with expert field engineers to collect their opinions. As seen by these engineers, the top five factors are as follows: changes of orders, delays in decision-making and approval by clients, contractors' financing difficulties, poor site management and supervision by contractors, poor control of project progress.

I. INTRODUCTION

The UAE is one of the developing economies in the Middle East and the fastest growing in the GCC.The construction industry in the UAE is one of the largest sectors in the country's economy in recent years and the UAE government spent around $287 billion on construction between 2005-2013.In 2016,according to research by BNS Networks, the UAE spent$43.6 billion in the construction industry, including the development of infrastructure, residential, hotels, schools and hospitals. Such a huge amount spentby the UAE government or bylocal governments in the UAE in the construction industry means a considerable financial risk if projects are delayed.

The UAE has witnessed a growth in the economy, leading tothe establishment of major projects by both government and private enterprises.In the last few years, the UAE has initiated large-scale projects, such as Dubai Palm, the extension of Abu Dhabi airport,a new extension of Dubai airport, a new airport at the Expo 2020 area (Al Maktoum airport), developing a new area for the Expo 2020 event, etc..All these projects were developed with high quality in design, materials and workmanship. In this regard,HisHighness, Shaikh Mohamed bin Rashid al Maktoum,Vice President and Ruler of Dubai, said; "the UAE will remain proactive in updating and utilizing the best practices and technologies that ensure the highest level of performance in all services".

Project delay can be defined as "time overrun either beyond completion date specified in contract, or beyond the date that parties agreed" (Assaf and Al Hejji, 2006). Delayin construction is one of the major problems affecting the economy and has severe consequences on most project goals (Kazaz et al.,2012)

"Delays have costly, risky and undesirable consequences on project success in terms of time, cost, quality and safety: those impacts are not only confined to the construction industry but they influence the overall economy of the country" (Sunjka et al., 2013).Delay in construction has been identified as a common problem world-wide. Multiple studies have identified delay as the major problem affecting project completion and project success.

II. RESEARCH OBJECTIVE

The objective of this study to determine the causes of delay and the effects construction delay in the UAE construction industry. This study was carried out in Dubai to determine the most important factors causing delay in building construction projects. This is part of a PhD study of delay factors in the UAE. Delay factors are categorized in this study into four groups: client factors, consultant factors, contractor factors and external factors. Many researchers have categorized the causes of delay factors in similar groups (Motaleb et al., 2013; Kim et al., 2016).

III. RESEARCH METHOD

To collect the information, a pilot questionnaire tool was used in this study, being more time- and cost-effective compared with direct interviews. A pilot questionnaire survey was designed based on previous research studies. The questionnaire form was designed in three sections. The first section is general information from the respondents. The second section concerns the causes of delay, divided into four groups. The third section concerns the effects of construction delay.

A random sample method was used to distribute the questionnaire survey to engineers working in the UAE. In total, 200 questionnaires were distributed to expert engineers working in the UAE construction industry;63% responded and complete usable questionnaires are summarised in the table below.

Table 1: Questionnaire distribution and returns

Target Group	Questionnaire distributed	Returned completed	Response Rate
Engineering consultants	60	40	67%
Building and civil engineering contractors	70	48	68%
Project managers	30	20	67%
Clients /client representatives	40	18	45%
Total	200	126	63%

Method of data analysis

The data collected from the survey were analysed using a frequency and severity index method (Alamri and Amoudi, 2017; Koshe, 2016; Samarah and Bekr, 2016; Bagaya and Song, 2016; Taha et al., 2016; Bekr, 2015), using the SPSS statistics program and Microsoft Excel 2016.

The importance index method was used to rank each delay factor based on frequency of occurrence, as well as the degree of impact. The details of the formula are as follows.

Frequency Index (F.I.) is used to rank delay factors based on frequency of incidence as identified by the contributors. The formula, as shown below, was:

$$F.I = \sum_{a=1}^{5} (a*n/5*N)*100 \quad (1)$$

Where; a is the constant expressing weighting given to each response (ranges from 1 for never up to 5 for very often), a is the frequency of the responses, and N is total number of responses.

Similarly, Severity Index (S.I.) is used to rank delay factors based on the degree of severity as designated by the contributors. The formula, as shown in the equation below, was:

$$S.I = \sum_{a=1}^{5} (a*n/5*N)*100 \quad (2)$$

Where; a is equal to the constant expressing weighting given to each response (ranges from I for Never to 5 for very severe), n is the frequency of the responses, and N is total number of responses.

Importance Weight: The importance index of each factor is calculated as a function of both frequency and severity index, as shown in equation below

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

Results and discussion

116 causes of delay were identified and categorized into 4 groups: client,consultant, contactor and external factors, as shown in the tables below.

Client related factors

The table below shows the top 10 factors related to the client.

Table 2: Client-related factors

	Client's factors	FII	SII	IMP.I
1	Changes of orders	0.721	0.730	0.526
2	Delaysin decision-making and approval	0.711	0.683	0.485
3	Changes in client requirements	0.657	0.595	0.391
4	Financial difficulties	0.502	0.706	0.354
5	Delays in material to be supplied by the client	0.619	0.541	0.335
6	Delaysin releasing contractor progress payments	0.554	0.603	0.334
7	Lack of client experience in construction	0.543	0.556	0.302
8	Unrealistic construction duration	0.492	0.579	0.285
9	Poor communication with project teams	0.538	0.514	0.277
10	Unrealistic design duration imposed	0.465	0.514	0.239

Consultant factors

Table 3: Consultant-related factors

	Consultant factors	FII	SII	IMP.I
1	Slow decision-making by consultant	0.562	0.630	0.354
2	Poor supervision	0.602	0.508	0.306
3	Delay insite inspection	0.532	0.575	0.306
4	Delay inapproval ofcontractor submission	0.603	0.503	0.304
5	Neglect of authority's requirements in design drawings	0.522	0.562	0.293
6	Poor coordination with project teams	0.541	0.519	0.281
7	Neglect of coordination between project drawings	0.475	0.575	0.273
8	Poor communication with project teams	0.597	0.454	0.271
9	Consultant engineer overload	0.617	0.437	0.270
10	Conflict between the specifications and drawings	0.476	0.519	0.247

Contractor related factors

Table 4: Contractor-related factors

	Contractor factors	FII	SII	IMP.I
1	Contractor financing difficulties	0.713	0.665	0.474
2	Poor site management and supervision by contractor;	0.702	0.668	0.469
3	Poor control of project progress	0.646	0.606	0.392
4	Poor planning	0.621	0.611	0.379
5	Payment problem between contractor and subcontractor /supplier	0.602	0.610	0.367
6	Contractor overload	0.606	0.590	0.358
7	Poor subcontractor performance	0.556	0.627	0.348
8	Problem with project cash flow	0.554	0.622	0.345
9	Contractor not fully aware of the contract obligations.	0.598	0.511	0.306
10	Control of subcontractors by main contractors	0.487	0.578	0.282

External factors

Table 5: External factors

External factor		FII	SII	IMP.I
1	Market inflation	0.606	0.487	0.295
2	Inclement weather conditions	0.451	0.408	0.184
3	Interpretation of regulations by authorities	0.360	0.456	0.164
4	Government change to the regulations and law	0.373	0.416	0.155
5	Poor site condition	0.376	0.360	0.136
6	Delay inreleasing approval of the drawing and work permit	0.302	0.403	0.122
7	Problems with site neighbours	0.419	0.232	0.097
8	Transportation problems	0.349	0.241	0.084
9	Unexpected underground condition	0.271	0.278	0.075
10	Geological problems on site	0.286	0.259	0.074

Overall ranking factors (top 25 factors)

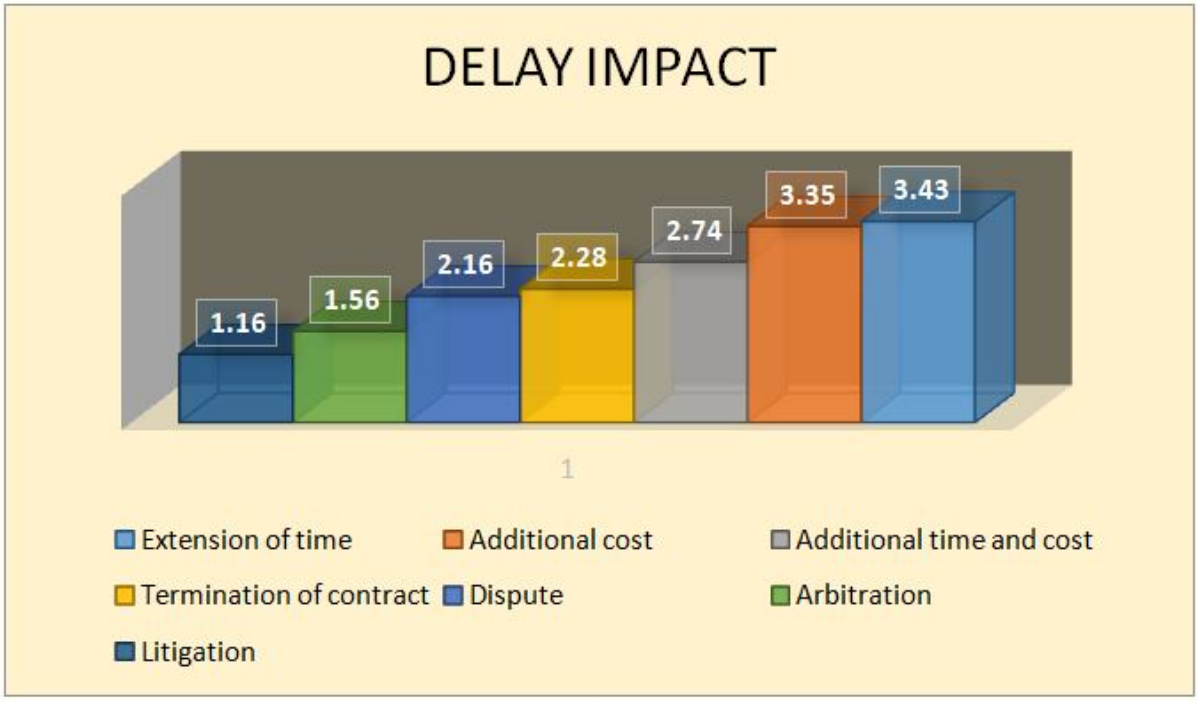
Table 6: Top 25 Factors

	Overall ranking	FII	SII	IMP.I	Groups
1	Changes of orders	0.721	0.730	0.526	Client
2	Delay in decision-making and approval	0.711	0.683	0.485	Client
3	Contractor financing difficulties	0.713	0.665	0.474	Contractor
4	Poor site management and supervision by contractor	0.702	0.668	0.469	Contractor
5	Poor control of project progress	0.646	0.606	0.392	Contractor
6	Changes in client requirements	0.657	0.595	0.391	Client
7	Poor planning	0.621	0.611	0.379	Contractor
8	Payment problem between contractor and subcontractor /supplier	0.602	0.610	0.367	Contractor
9	Contractor overload	0.606	0.590	0.358	Contractor
10	Financial difficulties	0.502	0.706	0.354	Client
11	Slow decision-making	0.562	0.630	0.354	Consultant

12	Poor subcontractor performance	0.556	0.627	0.348	Contractor
13	Problem with project cash flow	0.554	0.622	0.345	Contractor
14	Delay in material to be supplied by the client	0.619	0.541	0.335	Client
15	Delay inreleasing contractor progress payments	0.554	0.603	0.334	Client
16	Contractor not fully aware of the contract obligations.	0.598	0.511	0.306	Contractor
17	Poor supervision	0.602	0.508	0.306	Consultant
18	Delay insite inspection	0.532	0.575	0.306	Consultant
19	Delay inapproval to contractor submission	0.603	0.503	0.304	Consultant
20	Lack of client experience in construction	0.543	0.556	0.302	Client

Delay impact

As shown in the figure below, seven potential effects of delays have been identified: extension of time, additional cost and addition of both time and cost wereranked the highest three effects by respondents. This result matched the top causes of delay (Changes of orders, Delay in decision-making and approval by client), which lead to additional project time or cost or both time and cost. Moreover, the results are also in agreement in principle with other published studies related to causes of delay in the UAE (Motaleb&Kishk, 2010) and in agreement with other studies (Kikwasi, 2012; Sambasivan and Soon, 2008).



CONCLUSIONS

The study objective was to determine the causes of delay and the effects of construction delay in the UAE construction industry. A questionnaire survey was developed based on a literature review and distributed to engineers in the construction industry. A total of 106 causes of delay were identified and categorized into four groups;client, consultant, contractor, and external factors.

Data were analysed by using a frequency and severity index method, showing that the top 20 causes of delay were45% related to contractors,35% related to clients and 20% related to consultants. The external factor group was not in the top 20 causes of construction delay.

The effects of construction delay were investigated, and extension of time and additional cost were found to be the chief effects of construction delay.

A fresh perspective and indication has been provided in this study of the most important causes and effects of delays in construction projects. Limitations of this study relate to thesample size and the allowed for conducting the research study. Moreover, this study was general for the construction industry; it might be preferable to make specific studies of different types of construction project, such as building construction (residential and commercial), private housing ,highways …etc.

RECOMMENDATION

Based on the study output, the points below are recommended in order to prevent, minimize and control delays in construction projects.

- Clients should avoid or minimize changes of orders during the construction stage.
- Clients should work with the project team to avoid delays in decision-making and approval.
- Clients should be capable financially before project construction.
- Clients should hire professional engineering consultants.
- Contractors should have a capable and professional project manager.
- Contractors should plan work progress and control site activities.
- Contractors should manage financial resources for the project
- Contractors should maintaintraining levels for employees and staff for project planning and control.
- Contractors should not take on more projects than they can handle, risking losing control of all projects.
- Contractors should be fully aware of the contract obligations before signing the contract.
- Consultants should work closely with project stakeholders.
- Consultants should be capable to manage and control contractors' activities.

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