

AN INVESTIGATION INTO CAUSES AND EFFECTS OF CONSTRUCTION DELAYS IN UAE

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A major criticism of the United Arab Emirates (UAE) construction companies is the growing rate of delays in project delivery. The objective of the research work that underpins this paper was to investigate the causes and effects of construction projects delays in the UAE. The study was based on literature review and a questionnaire survey that investigated 42 potential delay factors. Questionnaires were sent to 50 companies with a response rate of 70%. Typical results have shown that change orders, financial and other client-related factors are the most significant causes of delay. Besides, cost and time overruns are the most significant effects. These results are in partial agreement with previous studies. However, some of the results are surprising and have implications regarding the need of training clients and their representatives but also project teams.

Keywords: client, delay, project management, United Arab Emirates.

INTRODUCTION

Construction delay can be defined as the time overrun either beyond the contract date or beyond the date that the parties agreed upon for delivery (Assaf and Al-Hejji 2006). Construction delay is considered one of the most recurring problems in the construction industry. Construction projects can be delayed as a result of a large number of factors. Monthly payment difficulties from agencies, poor contractor management; material procurement, poor technical performances, and escalation of material prices have been identified as the main delay factors in Ghana by Frimpong (2003). Lack of contractor competency, poor designers and estimation, unfixed management problems related to site and procedural techniques have been identified as major causes of delay in Vietnam by (Long *et al.* 2004). In Kuwait, the financial difficulties, changing orders, insufficient experience of clients and contractors are the main delay factors (Koushki *et al.* 2005). Change orders have been also identified as the main delay cause in Saudi Arabia (Assaf and Al-Hejji 2006). Inadequate planning, scheduling and financing by contractor, and change orders by clients have been reported to be the main factors causing delay in Jordan (Sweis *et al.* 2008).

Delays have an adverse impact on project success in terms of time, cost, quality and safety (Association of Project Managers 2006, Arditi and Pattanakitchamroon 2006). Construction stakeholders have to think about the nature of these problems by more analysis and studies (Theodore *et al.* 2009). The effects of construction delays,

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however, are not confined to construction companies, but can influence the overall economy of a country like the United Arab Emirates (UAE), where construction plays a major role in its development and contributes 14% to the GDP.

In the UAE, local and foreigner investors attract people to own and invest in properties. This trend has resulted into the growth of population in a very short time and affected the GDP (Abu Dhabi Chamber Commerce and Industry 2009). Clients and investors are complaining of non receipt of their projects on time since delays take many years and gets on one of the most critical problem in the UAE. A study by Faridi and El-Sayegh (2006) revealed that half of construction projects in the country encounter delays. According to Motaleb (2009), the number of construction projects encountering delay increased by about one fifth by 2009.

Although the current global financial crisis that hit the world recently affected the rapid development in the UAE, there is still a huge construction activity in the country. According to a recent investigation into the current and future state of the construction industry in Dubai (Global Real Estate News Centre 2009), more than half of the construction projects in real estate, infrastructure, and leisure and entertainment in the UAE, worth \$582 billion, are now on hold. However, that still leaves construction projects worth almost \$700 billion going ahead. So, it is crucial to identify the main causes and effects of delay of construction projects in the UAE.

The objective of the research work that underpins this paper was to identify the main causes and effects of construction project delays in the UAE. This is part of a PhD project aiming at the development of a framework for the effective management of construction delays in the UAE.

RESEARCH METHOD

Questionnaire design

A questionnaire survey has been designed on the basis of an extensive literature review of various causes and effects of project delay. Questionnaires were used because of their convenience and cost and time effectiveness when compared to face-to-face interviews given that the population companies are scattered in various parts of the UAE. Besides, they are less intrusive than telephone or face-to-face surveys which may result a better response rate as was identified in the pilot study. The questionnaire was carefully designed to avoid several shortcomings associated with questionnaire surveys including poor response rates, and problems relating to question construction and wording.

The questionnaire was designed so that that it is easy to read and responses are easy to fill in. Besides, open-ended questions were minimized as they could generate large amounts of data that can take a long time to process and analyse. The questionnaire consists of three sections. The first section was intended to gather information about the respondents' profile. The second and third sections relate to questions on the causes and effects of construction projects delays, respectively. These sections were designed to obtain the responses on a five-point scale that indicates the relative importance of various delay causes and effects. This was mainly based on a synthesis of potential delay causes and effects identified in previous research (e.g. Al-Khalil and Al-Ghafly 1999, Odeh and Battaineh 2002, Koushki *et al.* 2005, Assaf and Al-Hejji 2006, Lo *et al.* 2006, Sweis *et al.* 2008, Motaleb 2009).

Questionnaire content validity

To minimize the possibility of the respondents not understanding the terminology and layout of the questions, the questionnaire was piloted on two contractor respondents and two consultant respondents. Based on their feedback some alterations were carried out.

Questionnaire administration

The questionnaire was then distributed to a random sample of 50 experts working in local consulting, project management and contracting companies. Responses to the questionnaire were then collected and analysed. 35 responses were received with a good response rate of 70%. All responses were complete and usable. These represented 15 consultants, 8 project managers, and 12 contractors.

Method of data analysis

The data analysis was carried out in two folds using SPSS for Windows and Microsoft Excel. SPSS was used to generate the frequency (f_i) of the response category index for the cause and effect factors. The relative importance index (RII) for each factor was calculated using the frequency data for each response categories generated from SPSS.

The RII is the calculation of the mean frequency of each responses category index for the probability and impact. It is calculated as:

$$RII = \frac{\sum_{i=1}^n w_i f_i}{\sum_{i=1}^n f_i},$$

Where f_i is the frequency of the i^{th} response and w_i is the weight assigned to the i^{th} response.

Spearman rank correlation coefficient (r_s) was also used to determine the strength of relationship between the consultants and project managers ranking for various factors. It is a measure of correlation between two series using the ranks rather than the actual values (Kottegoda 1997, Coakes *et al.* 2009) and can be calculated as:

$$r_s = 1 - \frac{6 \sum_{i=1}^n d_i^2}{n^3 - n},$$

where d_i is the i^{th} difference in ranking between consultants and project managers. The higher the value of r_s approaching 1 or -1, the stronger the association between the two sets of ranking (Odeh and Battaineh 2002).

RESULTS AND DISCUSSION

Causes of delay

42 causes of delay have been identified and grouped into 5 sets: contractors, consultants, project managers, clients, financial and other unforeseen factors as shown in tables 1 to 6, respectively. The top 15 factors are summarized in Table 7.

Contractor factors

As shown in Table 1, there are 16 contractor-related causes of delay. Only two of these factors are among the top 15 (Table 7): late delivery of materials, ranked 9th, inappropriate construction methods, ranked 15th. Contractors have to ensure that all resources such as materials are available throughout the project whenever needed.

Table 1: Contractor factors

Factor Number	Factor Description	RII		
		Consultants	Project Managers	Overall
1	Late delivery of materials	4.050	4.000	4.029
2	Slow mobilization of labour	3.600	3.670	3.635
3	Shortage of skilled labour	3.750	3.800	3.775
4	Labour productivity	3.920	3.820	3.870
5	Labour supply	3.810	3.820	3.815
6	Absenteeism	2.940	2.850	2.895
7	Strike.	3.150	3.000	3.075
8	Low motivation /morale	3.190	3.060	3.395
9	Insufficient numbers of equipment.	3.700	3.010	3.355
10	Equipment allocation problems	3.670	3.600	3.365
11	Inadequate modern equipment	3.540	3.600	3.570
12	Unreliable sub- contractor	3.460	3.880	3.670
13	Inappropriate construction methods	4.020	3.880	3.950
14	Inadequate contractor experience.	3.950	3.850	3.900
15	Contractor's financial difficulties	4.060	3.832	3.946
16	Inaccurate site investigation	4.020	3.764	3.892

Accurate time estimations of materials delivery require accurate project information in terms of quality of information and information flow, availability and supply of resources.

Consultant and project manager factors

There are no consultant-related factors, Table 2, among the top list (Table 7). However, it should be noted that consultants as well as project managers contribute to time and cost estimating, Table 3, that have appeared in the top list in the 11th and 15th places, respectively. Besides, both consultants and project managers contribute to some extent to other factors including poor site management and supervision, improper project planning and scheduling, incompetent project team, and inappropriate construction methods which appeared in the top 15 list.

Client factors

All the client-related factors (Table 4) are among the top list (Table 7). Change orders, lack of capability of client representative, slow decision making by client, and lack of experience of client in construction are the most important causes of delay as they ranked first to fourth, respectively. Excessive change orders can cause significant disruption in projects and, consequently, cause change in the schedules, increase costs through rework and decrease labour efficiency.

Accurate time estimations of materials delivery require accurate project information in terms of quality of information and information flow, availability and supply of resources. Although contractors were perceived to cause these inaccurate estimates, as discussed earlier, as they are the ultimate party who produce estimates, it can be argued that clients are responsible as the party that issues excessive change orders. Poor estimation and change management reflect lack of efficient and effective project

Table 2: Consultant factors

Factor Number	Factor Description	RII		
		Consultants	Project Manager	Overall
17	Inadequate consultant experience	3.730	3.820	3.775
18	Poor design and delays in design	3.700	3.850	3.775
19	Incomplete drawing/details design	3.793	3.696	3.745
20	Slow response and poor inspection	3.670	3.638	3.654
21	Improper project feasibility study	3.624	3.505	3.565

Table 3: Project manager factors

Factor Number	Factor Description	RII		
		Consultants	Project Manager	Overall
22	Incompetent project team	4.100	4.120	4.110
23	Inadequate project management assistance	3.980	3.894	3.937
24	Inaccurate time estimating	4.070	4.014	4.042
25	Inaccurate cost estimating	4.050	3.990	4.020
26	Poor site management and supervision	4.010	4.250	4.130
27	Improper project planning / scheduling	4.063	3.980	4.023
28	Lack of communication /coordination	3.880	3.860	3.870

management.

Financial factors

Five financial-related causes of delay have been identified and are summarized in Table 5. Three of these factors are among the top 15 list (Table 7). These are: inflation and prices fluctuation, high interest rate and client's financial difficulties. These results are logical given the recent high escalation of prices of steel and cement, the current credit crunch and the related economic crisis in Dubai.

Other unforeseen factors

This group of causes was ranked low by both consultants and project managers as shown in Table 6. None of these factors is among the top fifteen factors (Table 7). This is particularly true for problems with neighbours. It seems that affected people near sites are usually well informed about projects and satisfactory compensation offered for their properties. Besides, environmental and social impact assessments are fairly carried out when necessary in the UAE. These will ensure that projects run smoothly without interruptions during construction phases.

Conformity between consultants' and project managers' rankings

A further analysis was done to find out the conformity between consultants and project managers, by using the Spearman rank correlation coefficient (Equation 2). This coefficient was found to be 0.918 indicating a strong conformity between consultants and project managers for the ranking of the causes of delays.

Table 4: Client factors

Factor Number	Factor Description	RII		
		Consultants	Project Manager	Overall
29	Change orders	4.240	4.290	4.265
30	Slow decision making by client	4.200	4.163	4.182
31	Lack of capability of client representative	4.180	4.201	4.191
32	Lack of experience of client in construction.	4.190	4.068	4.125
33	Client's financial difficulties	3.900	4.077	3.987
34	Unreasonable constraint to client	3.974	3.990	3.982

Table 5: Financial factors

Factor Number	Factor Description	RII		
		Consultants	Project Manager	Overall
35	Inadequate fund allocation	3.770	3.842	3.806
36	High interest rate	3.990	4.000	3.995
37	Monthly payment difficulties	3.570	3.640	3.605
38	Inflation/prices fluctuation	4.060	4.090	4.075
39	Delay payment to supplier/ subcontractor	3.863	3.650	3.757

Table 6: Unforeseen factors

Factor Number	Factor Description	RII		
		Consultants	Project Manager	Overall
40	Unforeseen ground/weather condition	3.880	3.860	3.870
41	Obsolete technology	3.460	3.580	3.520
42	Problem with neighbours.	3.440	3.430	3.435

Effects of delays

Six potential effects of delay have been identified as shown in Table 8. Time and cost overrun are the two most important effects of delays, ranked first and second respectively by both consultants and project managers. These results are in good agreement with the results of important causes of delay. Out of the top causes of delay (Table 7), there are at least five factors that can cause of time overrun including change orders, slow decision making by client, lack of capability of client representative, construction financial difficulties and late delivery of materials. Besides, there are at least five factors that can result in cost overrun including: inaccurate cost estimate, inaccurate time estimate, poor site management, incompetent project team, and improper project planning and scheduling.

These results are also in general agreement with other published work related to other developing countries, e.g. Aibinu and Jagboro (2002) in Nigeria, and Wiguna and Scott (2005) in Indonesia.

A comparative study

A similar study was carried out for the construction industry in the UAE (Faridi and El-Sayegh 2006). Table 9 summarizes the rank order, if any, of the top 15 causes of

Table 7: Top 15 factors based on all responses

Factor Description	RII	Rank
Change orders	4.265	1
Lack of capability of client representative	4.191	2
Slow decision making by client	4.182	3
Lack of experience of client in construction	4.125	4
Poor site management and supervision	4.130	5
Incompetent project team	4.110	6
Inflation/prices fluctuation	4.075	7
Inaccurate time estimating	4.042	8
Late delivery of materials	4.025	9
Improper project planning / scheduling	4.022	10
Inaccurate cost estimating	4.020	11
High interest rate	3.995	12
Client's financial difficulties	3.987	13
Unreasonable constraint to client	3.982	14
Inappropriate construction methods	3.950	15

Table 8: Ranking order of effects of delay

Rank	Effect Description	RII		
		Consultants	Project Manager	Overall
1	Time Overrun	4.160	3.750	3.960
2	Cost Overrun	3.830	3.370	3.600
3	Dispute	2.420	2.750	2.585
4	Arbitration	2.200	2.500	2.350
5	Litigation	1.900	2.000	1.950
6	Total Abandonment	2.250	0.917	1.584

Table 9: Ranking of current top causes of delay in 2006

Factor Description	Current Rank	2006 Rank	Rank Change
Change orders	1	27	-26
Lack of capability of client representative	2	2	0
Slow decision making by client	3	---	Not applicable
Lack of experience of client in construction	4	---	Not applicable
Poor site management and supervision	5	19	-14
Incompetent project team	6	12	-6
Inflation/prices fluctuation	7	---	Not applicable
Inaccurate time estimating	8	---	Not applicable
Late delivery of materials	9	6	+3
Improper project planning / scheduling	10	23	-13
Inaccurate cost estimating	11	8	+3
High interest rate	12	---	---
Client's financial difficulties	13	10	+3
Unreasonable constraint to client	14	17	-3
Inappropriate construction methods	15	7	+8

delay in both the current work and their 2006 study. Ten of the top 15 factors were also reported in the 2006 study. Apart from lack of capability of client representative, ranked 2nd in both studies, the ranking order of all other common factors has changed.

The change orders factor has changed considerably from the 27th place to become the most important factor. This is followed by poor site management and supervision and Improper project planning/scheduling which moved up 14 and 13 places to be the top 5th and 10th, respectively, causes of delay in the current study. Incompetent project team moved up six places to be the 6th top factor. Inappropriate construction methods, however, moved down the list 8 places. The remaining 4 factors changed up/down by 3 places.

CONCLUSIONS AND THE WAY FORWARD

The objective was to investigate the causes and effects of construct project delays in the UAE. Data was collected through an extensive literature review and a questionnaire survey distributed to a group of experts working in local consulting, project management and contracting companies operating in the UAE.

Forty two potential causes of construction projects delay have been identified and categorized into contractor, consultant, project managers, client, financial, and unforeseen categories. The significance of these factors has been investigated using the relative importance index method. The fifteen top causes of delay include 6 client-related factors, 4 project manager-related factors, 3 financial factors, and 2 contractor-related factors. Client-related factors seem to be the most significant causes of delay. This is followed by project team/ management related factors and various financial factors faced by the contractor.

These results are in general agreement with published previous studies and the current economic crisis in the UAE. However, some of the results are surprising and have implications regarding the need of training clients and their representatives but also project teams.

The effects of construction delay have also been investigated. Time and cost overrun have been found to be the two most important effects. This is in good agreement with the identified significant causes of delay.

This study has provided a fresh perspective and evidence on the most significant delay causes and effects. These results have clear implications for the construction sector in the UAE and the construction industry in general. Further future work includes conducting a well grounded survey of construction delays in the UAE to triangulate the initial approach adopted in this research findings. This will equally address the limitations of the study considering the sample size and the methodology adopted.

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