

INVESTIGATING THE CAUSES OF VARIATION WITHIN THE CONSTRUCTION PROJECTS IN UAE

Mohamed Salama¹ and A. P. Habib

School of Management and Languages, Heriot Watt University, Edinburgh, EH14 4AS, UK

This study has been conducted before the economic crisis that started in the third quarter of 2008. Over the past decade, the construction industry in UAE in general and Dubai in particular witnessed an unprecedented boom. However, despite the readiness of financial resources as well as the active participation of multinational construction companies, the construction projects suffered from considerable variations in time and cost. The study aimed at investigating the main attributes of the construction industry in Dubai in an attempt to identify the key factors that cause variations. The research comprised a set of semi-structured interviews to identify the factors followed by a questionnaire to investigate the probability of occurrence and the impact of the main factors on time and cost. The results indicated that the prevalent intervention of the clients in the decision making process throughout the project lifecycle coupled with the scope creep are the main causes of variation in time and cost. In addition, the results reflected the gap between supply and demand in the construction sector due to the rapid growth fuelled by the needs of the fast growing economy in UAE. The study concluded with recommendations to create more awareness among stakeholders, and especially clients, of the importance of the initiation and planning phases of the project to hedge against future variations. The main findings of this study are still envisaged as significant despite the financial crunch.

Keywords: cost, Dubai, time, variation, client.

THE CONSTRUCTION INDUSTRY IN UAE

In UAE the construction industry contributes almost 7.5% of non-oil GDP besides being a vital source of employment. In the first quarter of 2004, almost 6000 construction companies were registered; 2119 buildings were completed including 1,436 villas and residential complexes, 393 multi-storey commercial buildings and 290 industrial, entertainment and service buildings (Belaid and Bader, 2005).

According to a study by EFG-Hermes, an Egyptian investment bank with offices in Dubai, the real estate and construction sectors have become the centrepiece of Dubai's economy. Hanware (2005) estimated that at least \$50 billion of residential projects will be built in the next four years, including at least 85,000 new homes.

In 2003, the construction industry employed 111,700 employees, which is 15% of the total employees in UAE with a soaring trend to meet the demand due to the increasing volume of construction. During the period 2000-2003, the number of employees in the construction industry in Dubai increased by 33%. Moreover, after allowing expatriates to own property in Dubai in 2002, the freehold market and the property market have witnessed a remarkable growth that has contributed to the expansion of the

¹ M.a.salama@hw.ac.uk

construction industry. The number of freehold properties was expected to double by 2009. (ASTECCO, 2005).

Dubai has 30,000 of the world's total 125,000 construction cranes and US\$300bn worth of projects in progress (Gulf news, 2006). However, as the statistics indicate, around 90 to 95% of all construction projects witness an overrun in time and/or cost. For example, the Mall of the Emirates, a 223,000 square meter shopping centre was tendered for an amount of approximately AED 600million and scheduled for 18 months. The final figures soared up to AED 850millions upon completion, i.e. around 38.5% increase in cost. The Dubai Police headquarters building, which is a landmark in Dubai, was tendered for a value and duration of AED 115 millions and 18 months respectively. The figures at completion were 26 months and AED 147 millions i.e. 28% over budget and 44% over scheduled duration. The same project attracted a total of 180 variation claims out of which 165 were approved.

RESEARCH METHOD

The study aimed at investigating the main factors that lead to time and cost variation in the construction industry in Dubai and particularly the building projects despite the booming economy which suggests the availability of both knowledge and skills: readiness of resources and active participation of multinational construction firms.

The study started with a review of the factors stated in the relevant literature both in the global construction market and in the Middle East in particular.

The research design comprised a set of seven semi-structured interviews in which experts with a minimum of 25 years experience were asked to identify the factors they perceived as the most important drivers for variation. The seven interviewees were selected purposively to represent the different backgrounds (nationalities) in Dubai; namely Locals, Asians, Arabs, Europeans and others. Also, the selected sample had to satisfy the criteria of having a minimum of 10 years experience in Dubai building industry. This was particularly difficult with western expatriates who, in general, have an average stay in Dubai of years only. The interviews were conducted via face to face meetings and the information was recorded through note taking. The interviews lasted for 45 minutes in average. The output of the interviews was consolidated into a questionnaire that was sent to a sample of 55 project managers out of which 23 responded, representing a response rate of 42%. The questionnaire comprised of two main sections. The first section asked the respondents about their, qualifications, nationality, current post, years of experience in general and in Dubai market in particular, and the type and size of projects they were involved in. For the purpose of this study, it was resolved to use a High/Low scale, whereby the respondents were asked to rank the pre-identified factors. The data collected were presented and analysed through a set of frequency distribution charts as shown below in the data collection and discussion sections.

The study concluded with recommendations for the Dubai building industry based on the research findings.

In the following section, a purposive review of the literature is presented. The aim of this section is to pinpoint the factors identified by scholars and fellow researchers in previous works rather than to critically discuss the theory. These factors had been discussed with the surveyed sample during the interviews and the output was utilised in constructing the questionnaire for the second stage of the data collection.

LITERATURE REVIEW

Time and cost overruns are significantly a lose-lose situation for all the stakeholders involved in the project (Eden *et al.*, 2005). The increase in cost of materials due to inflation, inaccurate material estimating and the degree of project complexity results in cost overruns. Whereas design changes, poor labour productivity, inadequate planning, and resource shortage were mentioned amongst the important factors that cause delays.(Arian and Pheng , 2005)

Failure to apply the appropriate project management tools and techniques would result in overruns and lead to rework due to the absence of quality tools and techniques essential for performance improvement (Love *et al.*, 2000).

Al Momani (1996) investigated the causes of delay on 130 public projects in Jordan. The results indicate that the main causes of delay in the construction of public projects relate to project designers, user changes, weather, site conditions, late deliveries, and economic conditions. Assaf (1987) investigated the main causes of delays in large building projects and their relative importance and the main causes of delay that exist in Saudi Arabian construction projects. This study classified the factors according to key stakeholders' perspective, namely the contractors, consultants and owners. The contractors' factors included design change, preparation and approval of drawings, subcontractors' progress and payment by owners. The consultants' factors included cash problem during construction; relationships and slow decision making by owner. The owners' factors included design error; labour shortage and inadequate labour skill.

Koushki and Kartam (2004) investigated the impact of construction materials on time and cost of construction projects in Kuwait. 450 residential projects were studied. The research delved into various sub-factors that are the drivers for cost overrun due to materials. The factors included selection, availability, late delivery and price inflation during the construction. They concluded that one fourth of the projects were delayed due to late material delivery while price inflations accounted for cost overrun in approximately 13% of projects.

Koushki *et al.* (2005) investigated the delays and cost increases in construction projects in Kuwait. The study stated that the three main causes of time-delays included changing orders, owners' financial constraints and owners' lack of experience in the construction business. Regarding cost overruns, the three main causes were identified as contractor-related problems, material-related problems and, once again, owners' financial constraints. The minimisation of time delays and cost overruns in private residential projects would require: the availability of adequate funds, allocation of sufficient time and money at the design phase, and selection of a competent consultant and a reliable contractor to carry out the work.

Salama *et al.* (2005) studied the relationship between macroeconomic factors like GDP, exchange rates, interest rates and the cost of construction in Egypt. The study emphasised the impact of the macroeconomic factors on project costs especially during periods of economic turbulence. However, these factors are not considered to be embraced in the cost estimating process explicitly.

Eden *et al.* (2000) and Ciccarelli (2004) mentioned that a major factor during the execution phase is the intervention of the client to change the scope hence altering the project's time schedule and cost. Hatush *et al.* (2005) stated that clients change the

scope and requirements quite frequently without a proper recognition of the consequences thus resulting in project overruns. The study recommended freezing the design philosophies and suggested that changes should be allowed only under controlled circumstances.

DATA COLLECTION

Table 1: Factors leading to variation in time and cost

Factor Number	Factor Description	Factor Number	Factor Description
1	Design changes	13	No proper supervision of works executing
2	Inadequate knowledge for requirements	14	Insufficient machineries
3	Inaccurate budgeting and estimating	15	Clients being developers and investors
4	No proper surveying of existing conditions	16	Fast track projects
5	Client procured materials	17	Giving relationship preference over the authority of the consultant.
6	Delay in providing information	18	Insufficient time given to consultants for a complete design
7	Structural design problems discovered in the execution phase	19	The requirements are not well defined and explained for the design
8	Delay in approvals of materials	20	Scarcity of specialised subcontractor due to the high volume of construction
9	Delay in approvals of subcontractors	21	Coordination problem as more participants involved
10	Slow progress with respect to the schedule	22	Contractor evaluation not proper with respect to the construction volume
11	Inadequate skills	23	Client dominated market
12	Misinterpretation of scope		

To identify the main factors that cause delay and cost overrun particularly in Dubai building industry, semi structured interviews were conducted with seven experts. As Dubai has a diversified and multicultural population with nearly 88% foreign population (ASTEKO, 2005), a diversified sample of different nationalities and backgrounds was selected for the interview sample. The sample included representatives of the three main categories, namely the client, the consultant and the contractor with a minimum 15 years of experience in construction and an average of 25 years of experience for the whole sample. Also the interviewees had an average of 10 years of experience in UAE construction market covering a wide range of projects including residential, commercial and industrial buildings with values ranging from \$10m – \$170m mostly delivered by multinational construction companies. The interviews identified 23 factors as shown in Table 1.

A questionnaire comprising these factors was sent to a sample of 55 project managers from different nationalities with an average experience of 10 years in the construction industry asking them to classify the impact of each factor on time and cost overrun as well as the probability of occurrence for each factor. The questionnaire offered two categories: low and high. In addition, the respondents had the null option if the factor

under investigation had zero probability or no impact. However, this option was not chosen by any respondent. Also respondents were offered to add any factor that was not included in the questionnaire if needed.

The results based on 23 respondents were then segregated into three frequency tables for each factor. These are represented by three sets of graphs (probability, impact on time and impact on cost) as shown in figures 1, 2 and 3.

DISCUSSION

The following discussion is based on the outcome of the interviews whereby the surveyed sample provided valuable insights about the construction industry in Dubai in addition to the findings of the questionnaires. The results show that factors 1, 10, 16, 19 and 20 are most likely to occur. Four of these factors are interrelated. Fast track projects (16) are mostly associated with imprecision of scope (19) and design changes (1) that would slow the progress (10). Factor (20), the scarcity of specialised subcontractors, is an interesting finding that reflects a gap between the demand and supply in the construction sector in UAE in general and Dubai in particular. This gap is also manifested in factors 11, 13 and 14 reflecting the shortage in skills, and machinery.

Despite the readiness of resources, the hyper rate of development in the UAE and its implication on the construction sector has enhanced the tendency towards fast track projects. However, the industry lacks skills and machinery as the supply seemed to be lagging behind the fast moving demand thus rendering fast track projects a risky endeavour.

The type of client has an impact on the construction industry as illustrated in factors 15 and 23. Being mostly developers and big investors, clients seek to cut costs and time simultaneously. With an annual appreciation of 15-25% in the price of property in Dubai, the rush to enter the lucrative business is another factor that widens the gap between the supply and demand in the construction market.

The clients' propensity to rush the project phases is manifested in factor 18 which, when coupled with factors 2 and 4, reflects a lack of knowledge. This results in inaccurate estimates and design problems as stated in factors 3 and 7. The identified factors can be classified into three main categories:

(1) Factors that occur during the initiation and planning phase - mainly to do with a lack of clear definition of the project scope, leading to changes in the execution phase resulting in variations in time and costs.

(2) Factors that relate to the clients. Most clients are market driven and tend to expedite the project phases either by using a fast track approach or by squeezing the time allocated to the initiation and planning phase as mentioned above. Clients' intervention is one of the major factors that leads to variation as previously identified in the literature review section. Despite hiring qualified project management firms, in general, clients insist on playing a leading role in the approval of design, the selection of subcontractor and materials and introducing changes. This caused delays in approvals and in many cases affected the quality of the decision made. In addition, there is a cultural aspect that some times leads to preferring relationships over competences in the evaluation and selection processes especially for subcontractors and suppliers.

Figure 1

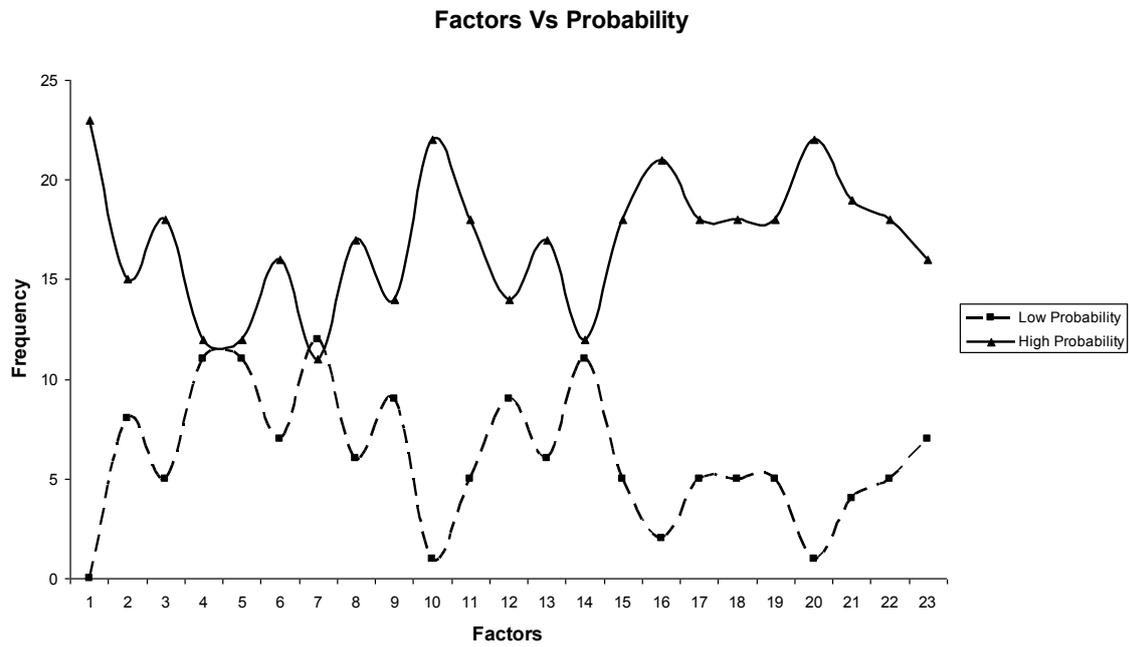


Figure 2

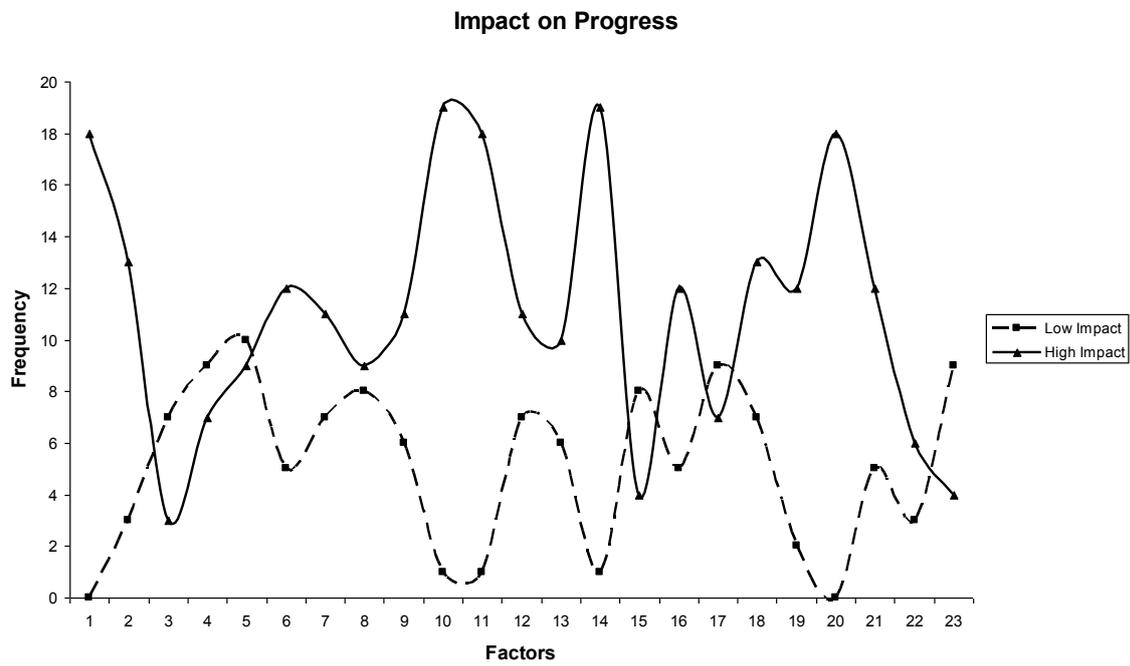
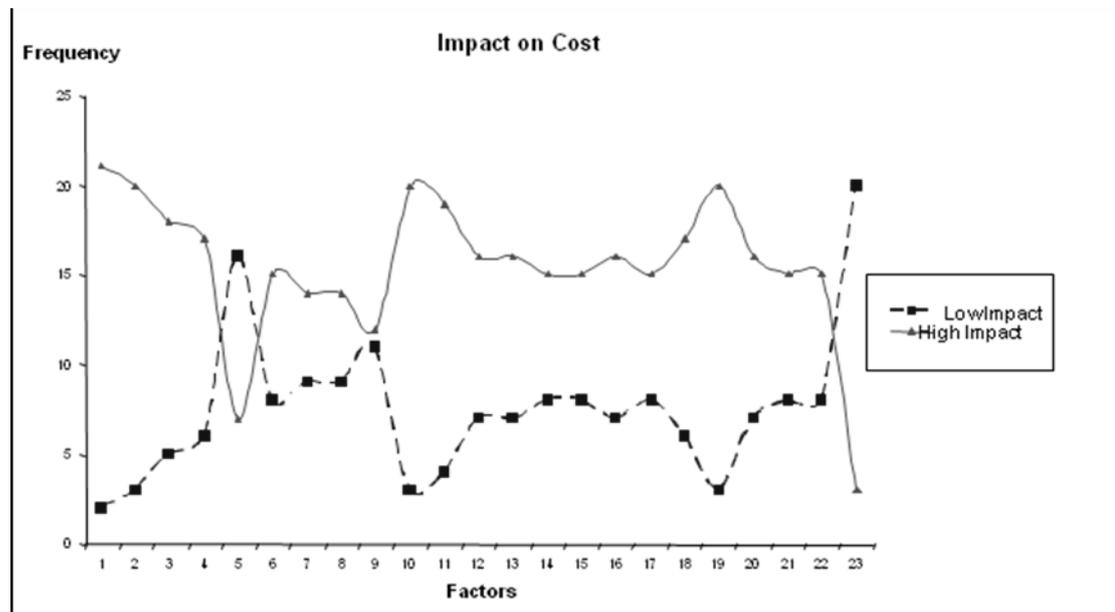


Figure 3



The construction market in UAE in general and Dubai in particular does not operate in isolation from the other sectors. Clients are mainly developers and investors with portfolios that embrace other businesses. In making decisions for the construction projects, investors in UAE often have other considerations that are not always aligned with the project management professional's approach and what is widely known as best practice. However, the continual intervention of the client in the key decisions through the project life cycle from start to finish is the real concern. Practitioners in Dubai for instance report a considerable number of cases whereby the client requests additional floors to a building after the construction has started or a review of the whole design to add flats to each floor to increase profits amid the execution phase.

(3) External factors that inflict on the construction industry and lead to unfavourable consequences at least in the short term (manifested in a shortage of skills and machinery in general and specialised subcontractors in particular). The rapidly growing economy of the UAE is associated with a fast moving mechanism of decision making that relentlessly reviews the rules and regulations to cater for the needs of the fast growing economy. Such changes may cause a gap between the demand and supply in the construction industry (at least in the short term) as was the case when Dubai allowed expatriates to own property in an attempt to boost up the property market whereby expatriates property owners in Dubai were to be allowed permanent residence in the country. The price of property in Dubai soared attracting more investors to enter the lucrative property market. It is worth noting that later on the local authorities withdrew this act and then recently replaced it in 2009 by a multi-entry Visa system that allows property owners to stay for a maximum of six months.

The lag in supply such as shortage in skills, subcontractors and machinery was identified as an important cause of the variations in projects as shown in figures 2 and 3.

In general, the findings mostly agreed with the literature emphasising the importance of the initiation and the planning phases where proactive measures can be factored in at an early stage to hedge against cost and time variations in the later stages.

Also, the results indicated that clients' intervention had negative impact on some project by delaying approvals or imposing changes during the execution phase. It can be claimed that this was due to a lack of scope definition at the initiation phase coupled with a lack of scope management plan.

RECOMMENDATIONS

In January 2007, the financial market in Dubai made an effort to create awareness among investors to conduct adequate research before embarking on risky endeavours that jeopardise the whole stock market. The discussion above suggests the need for a similar campaign targeting the clients in the construction industry by communicating the importance of the planning phase whereby a clear scope should be identified and agreed upon among stakeholders. Also there should be a mechanism for decision making that, besides being flexible to absorb the market changes should be based on set standards and a clear definition of roles and responsibilities. This would regulate the clients' intervention and act as a safeguard against decisions that yield unfavourable ramifications. Together with an effective configuration management system from the outset, the consequences of the inevitable changes could be managed proactively.

CONCLUSIONS

The study explored the main attributes of the construction industry in Dubai in an attempt to identify the key factors that cause variations in time and cost. The results indicated that poor planning manifested in the ambiguous scope definition leads to considerable scope creep in the execution phase. This, together with the clients' disorganised intervention imposing decisions in such a manner that contradicts what is widely known as best practice, is among the most significant causes of variation. The results also showed that there is a lack of skills and in some cases projects suffer shortages in machinery which suggests a gap between the demand and supply due to the continuing growth in economy.

The study indicated the need for effective measures to create awareness of the importance of the initiation and planning phases with emphasis on the clarity of scope and the set up of an effective configuration management system. Further more, the study recommended the establishment of an efficient mechanism that regulates the decision making process to hedge against any hasty decisions made by clients at the project level in response to the dynamic business environment in Dubai.

LIMITATIONS AND FURTHER DIRECTION

The sample size in this study is relatively small therefore a further detailed study pursuing a larger sample is being undertaken. The future study will investigate the sub sectors of the building industry in UAE, mainly the public and private sectors separately and in more depth with emphasis on the effect of delays and cost overruns on customer's satisfaction and the quantified impact on the building industry.

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