

CURRENT PRACTICE OF VARIATION ORDER MANAGEMENT IN THE SAUDI CONSTRUCTION INDUSTRY

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The complexity of construction projects means that it is unusual to deliver a project without any change during its project lifecycle. Liability to change is an attribute that generally characterises almost all projects. It is assumed that the use of a change management system in construction projects would assist the management of variation orders effectively. Variation order management is not fully understood nor well applied in the Saudi construction industry. In order to better understand the current practice of variation order management at the design stage of public sector construction projects in Saudi Arabia, this paper reports the results of an exploratory study that used a series of interviews with public sector clients and consultants in 2011. Findings indicate that there are currently no formalised approaches to the management of variation orders at the design stage. In addition, there is a general lack of knowledge about managing variation orders. The paper concludes that there is not only a need to apply an appropriate variation order management system to Saudi public sector construction projects at the design stage, but it also presents participants' suggestions of the most appropriate ways of doing so.

Keywords: design stage, public sector, Saudi Arabia, variation orders.

INTRODUCTION

The construction industry has been described as complicated and uncertain in nature, as each construction project has its own unique circumstances and conditions. The complexity of construction projects means that it is hardly possible to deliver a project without any change in its lifecycle, that is, every construction project is unique in many respects, but liability to change is an attribute that generally characterises almost all projects. This has led Revay (2002) to claim that change is 'a fact of life' for a construction project. Baxendale and Schofield (1986) define variation orders as any change that can occur to the basis that is different from the agreed and signed contract. Following the same line of thought, Ssegawa *et al.* (2002) explain that sources that

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might trigger change in a construction project can be as simple as a change of mind on the part of the clients, their consultant or unforeseen problems raised by the main contractor or sub-contractors.

This paper intends to investigate the current practice of managing variation orders in Saudi public construction projects, at the design stage, by conducting a series of exploratory interviews among some public sector clients and consulting firms. The paper also presents some suggestions of practical ways of applying an appropriate variation order management system to Saudi public sector construction projects at the design stage.

LITERATURE REVIEW

Variation orders at the design stage

It is well established in research into variation orders that the design stage is totally unlike the construction stage and, therefore, they are two separate functions. As a result of this separation, it is very unlikely that a project can be delivered without any variation orders during both the design stage and the construction stage (Ssegawa *et al.* 2002) and it is not an uncommon situation (Construction Industry Institute, 1990; Ibbs *et al.* 2001). In fact, Revay (2002) has been argued that there will certainly be variation orders in each single construction project in most, if not all, of their lifecycle of design, time, cost and quality. Ssegawa *et al.* (2002) further explain that the complex nature of construction projects suggests that, in order to finish a construction project, changes to plans or the construction process itself must be expected.

Therefore, the construction industry is subject to poor performance due to design and construction quality that may cause the occurrence of variation orders, which leads to time delays and cost overruns. Design changes are natural results of the design process. The complexity arises in multi-disciplinary design situations because changes made in one discipline commonly influence design descriptions in the other disciplines involved (Zaneldin, 2000). In fact, research indicates that the design stage is often distinguished by the high likelihood of changes in variation orders. This has been documented in more ways than one. Some examples are:

- Variation orders are easier to manage at the earlier phases, such as the design phase, simply because these variations do not require any rework or demolition (Arain and Pheng, 2007).
- During the early stage of design, variations can be conducted at minimum cost and have the greatest potential for maximum saving (Zaneldin, 2000).
- Motawa (2004) suggests that efforts should be focused to trim down the amount of variation orders at the design stage.
- Clough and Sears (1994) claim that any major variations or additions in the design phase may increase the project total cost.
- Variation orders at the design stage always lead to poor performance, whether they are owner-initiated or consultant-initiated (Oladapo, 2007).
- Clients who spend more time and money at the design stage reduce variation orders (Ndiokubwayo, 2008).
- Langford *et al.* (1986) states that the design team initiates 72% of the variation orders (cited in Akinsola, 1997).
- Oladapo (2007) emphasises that clients and consultants initiate the majority of the variation orders.

- The earlier that variation orders are managed, the greater time value will be recognised (Bearup, 1995).

Management of variation orders

Due to the inevitability of variation orders, as well as their potential impact on the planning, design, progress and completion of any given construction project, it is not uncommon for the literature to devote considerable time and effort to the experimentation and theorisation of how such orders can best be managed. In this respect, Arain (2008) asserts: “The issue of managing variations has received much attention in the literature. Despite many articles and much discussion in practice and in the academic literature, the issue of learning from past projects in making timely and more informed decisions for the effective management of variation orders has not been explored much in the literature”.

In fact, several strategies have been acknowledged as useful in managing variation orders. According to Charoenngam *et al.* (2003), among the various strategies used to manage variations is that of involving the creation of good communication and cooperation among project team members. Charoenngam *et al.* (2003) further explain that, in making information accessible to all stakeholders, it is important to establish such communication and cooperation and that is why the authors advise making good use of the Internet technology as the communication media, where accessibility to timely and accurate information is not bound to time and place. While Jacob (1978, pp. 64–65) noted that “lax attitudes and unfamiliarity with proper change order procedures have led to serious financial loss and insolvency”, Chan and Yeong (1995) assert that good contract documentation and good communication and cooperation between building team members are major elements that can make the task of managing change orders easier. As for good documentation, explains Chan and Yeong (1995), it is generally facilitated by designing an effective change order system, which should be geared towards understanding the change order process or “workflow”, which can be collected from the standard forms of contracts. With regards to good communication, however, it might be facilitated by providing information in a well-timed manner.

Motawa (2004) emphasises that, in order to improve the project change management, it is essential to adopt a change process model. For Motawa (2004), variation models can be adopted to facilitate the process of variations that have occurred or are about to occur. Ibbs *et al.* (2001) further state that identifying variation orders prior to their occurrence can assist the project team in managing variations better and earlier. Hence, if the project team established a knowledge-base of similar past projects, they would be capable of planning efficiently before conducting a project and during the design and construction stages, in orders to minimise variation orders and avoid their negative impact (Arain and Pheng, 2007). Similarly, Ibbs *et al.* (2001) suggest that having a systematic approach to managing change orders effectively in construction projects would minimise cost overruns and time delays. In a similar manner, Krone (1991) suggests a variation order process in which efficient administrative processing is promoted.

Following a similar line of thought, several research projects have been carried out into modelling change processes in the construction industry that attempt to identify the factors that affect the success of the change lifecycle, such as those by Motawa *et al.* (2007) ND Arain and Pheng (2007), amongst others.

Design performance in the Saudi construction industry

The Saudi construction industry is often seen as one of the largest construction industries in the Middle East. Furthermore, the construction industry is the second largest industry in Saudi Arabia (National Commercial Bank, 2010). In their article Arain *et al.* (2006) explain that the inconsistencies between design and construction have a negative impact on the performance of construction projects in Saudi Arabia. They also state that a number of factors are responsible. Some of these include: (a) the involvement of the designer as a consultant, (b) communication gaps occurring between the contractor and the designer, (c) insufficient details in the work drawings and (d) lack of coordination between the parties. In addition, Arain *et al.* (2006) also identified the lack of qualified personnel in the design firms, the designers' lack of knowledge of available materials and equipment and the use of incomplete shop drawings and specifications. Following the same line of thought in another study, Arain *et al.* (2007) state that inexperienced clients have led to the adoption of inadequate designs, resulting in many changes to drawings, specifications and contract terms and, therefore, to failure in project performance.

Similarly, a study conducted by Al-Dubaisi (2000) states that variation orders are the major cause of failure in construction project performance in Saudi Arabia. To this researcher, this failure occurs because the variation orders lead to cost and time overruns. Also, the results of the study indicate that cost overruns because of variation orders were in the magnitude of 6% to 10% of the original contract value. Time overruns due to variation orders were reported as being less than 10% of the original contract period. The study also concludes that the clients initiate most changes during the design phase. Furthermore, design errors are considered as the most significant cause of variation orders in large building projects in the Saudi construction industry. Mutaawaa (1988) explains that inadequacies in the design and construction stages, financial abilities and the behaviour of the construction parties were the most common causes of variation orders in the Saudi construction industry.

The quality management in the design and construction stages is a key factor in achieving a successful project. In this respect, Al-Abdulrazzak (1993) asserts that quality management practices in the design phase, such as drawing checks and the provision of clear, concise and uniform plans and specifications, have a significant impact on project performance. Further explanation by Bubshait *et al.* (1999) indicate that the aspects influencing quality activities in design firms are: (a) the major need for development in the quality of working relationships and (b) the need to overcome design errors that affect project performance, specifically staff training and performance quality audit. In the same way, Al-Musallami (1992) reports that clients are dissatisfied because of the high percentage of variation orders due to design errors, especially those that have a significant impact on project performance. Moreover, a study conducted by Assaf and Al-Hejji (2006) identified the failure in construction projects in Saudi Arabia. Their results indicate that several factors relating to design affect project performance. To Assaf and Al-Hejji (2006), these factors include: "mistakes and discrepancies in design documents; delays in producing design documents; unclear and inadequate details in drawings; the complexity of project design; insufficient data collection and surveying before beginning the design; misunderstanding of the client's requirements by the design engineer; inadequate design-team experience; and the non-use of advanced engineering design software".

Performance of Saudi public construction projects

Generally speaking, the Saudi construction industry is considered the same as any other construction industry in the world. According to Falqi (2004), the Saudi construction industry suffers from poor performance and faces some difficult challenges. In this respect, several local studies have proven that there is considerable poor performance in Saudi construction projects. A survey conducted by Al-sultan (1987) to examine the time performance in different types of construction projects in Saudi Arabia stated that 70% of construction projects experienced time overruns. Similarly, Alkhalil and Alghafly (1999) carried out a preliminary survey to evaluate the time performance in Water and Sewage Authority construction projects and found that 45, out of a total of 76, construction projects were delayed. Moreover, Alkhalil and Alghafly (1999) asserted that changes in the 76 projects evaluated were one of the major causes of delay. In the same way, Assaf and Al-Hejji (2005) conducted a survey to identify the causes of delay in large construction projects in Saudi Arabia. Surprisingly, all three parties involved in this survey state that variation orders are the most common cause of delay in the Saudi construction sector.

On the other hand, literature indicates that there are limited publications related to Saudi construction project performance, specifically with regard to variation orders. The public sector in Saudi Arabia is the major source of construction projects. Statistically speaking, the Saudi government has been the major client for the construction industry, accounting for approximately 67% of industry volume (Alsaqer, 2001). Government construction projects include a variety of projects, such as residential houses, highways, government office buildings, schools, hospitals, airports, utility projects, cultural and recreational facilities, power plants, etc.

RESEARCH METHODS

The lack of knowledge about the management of variation orders in Saudi Arabia and the limited published work in relation to the same topic in the Saudi construction industry has led this researcher to implement a qualitative approach. Semi-structured interviews were adopted as the main research technique. To Bryman and Bell (2003), the interview approach is the most commonly used research technique in qualitative approaches as this particular technique provides a flexible method that can be adopted to collect significant ideas and comprehensive opinions to enrich the research. A series of exploratory interviews was carried out with public sector clients and consulting firms in the Saudi construction industry. The general aim of the interviews was to better understand the current practice in relation to variation order management at the design stage. The interviews also aimed to identify whether or not there has been some sort of criteria for managing variation orders in the research context. In addition, the interviews intended to explore the existing/non-existing models or frameworks or IT-based software to manage variation orders and to confirm whether or not the research context is in need of a variation order management system. The semi-structured format of the interviews allowed a good opportunity to qualitatively make additional observations that would assist the subsequent development of the research.

Design of the exploratory interviews

An interview guide was designed in order to develop the interview questions. The guide was divided into four sections: interview topic, questions, objectives of the questions and response analysis. These four sections of the interview guide ensured

that (a) valid questions were asked and (b) how the questions would be evaluated and analysed. It was crucial in designing the interview guide to ensure that the sequence of the interview questions follows an order to facilitate moving between questions. The semi-structured interview consists of fourteen questions and these were divided into three main parts: (a) personal background, (b) management of variation orders in Saudi Arabia and (c) existing of models/frameworks or IT-based software to manage variation orders in Saudi Arabia.

Sample and data collection

The sample of the study consisted of members of the public sector clients and engineering firms involved in the Saudi construction industry. The rationale behind the sample selection was based on the possibility of (a) examining different perspectives, (b) issues and experiences and (c) gaining valuable diverse data to better understand the current practice of variation order management at the design stage. The public sector clients were the Saudi Ministries that have construction management departments. The selected participants amongst the public sector clients were project managers or client representatives for construction projects. The consultants were merely the certified consulting engineering firms from the Ministry of Municipal and Rural Affairs in Saudi Arabia. The selected participants from the consulting firms were design and/or project managers. The sample comprised 23 respondents in total, 7 from different public sectors and 16 from different consulting firms in Saudi Arabia. The interviews were performed through recorded phone calls during the last quarter of 2011. The total time spent on interviews is 710 minutes, with an average duration of 31 minutes for each interview and the spoken language was Arabic. The recordings were transcribed as Microsoft Word documents. The collected data from the semi-structured interviews were analysed manually and systematically as described by Ritchie *et al.* (2003). The analysis steps of the interviews consist of 9 major steps that derived to the key findings and problem confirmation. These steps are recording and transcribing, data familiarisation, theme and concept identifications, indexing the concepts, synthesis, categorisation, constructing thematic matrices, findings and problem confirmation.

FINDINGS AND DISCUSSION

The major findings of this study indicated that there is currently no formalised approach employed to manage variation orders at the design phase in the Saudi public construction projects. However, the conceptual framework of common practice has currently based itself on the responses, which can be divided into four main stages: identifying and evaluating variation orders, estimation and approval, implementation and documentation. In order to facilitate the research findings, a thematic matrix was constructed with extreme care with regards to the amount and content of the collected data. The constructed thematic matrix consists of two main topics, each of which consists of sub-topics that present key findings. The weightings of the key findings are measured based on how many respondents stated the finding. Table 1 shows a summary of the constructed thematic matrix and the frequency of the key findings by the study respondents.

Table 1: Shows the constructed thematic matrix

Topics	Sub-topics	Key findings						
Current practice of variation order management at the design stage in Saudi public construction projects.	Impact of variation orders.	Delay at design stage (14)*	Cost overruns (9)	Quality defects (8)	Disputes and conflicts (7)	Design errors (8)	Design productivity (7)	Design effectiveness (6)
	How variation orders are managed.	Straightforward process (13)	Identify variation (10)	Evaluate variation (8)	Estimate cost and time (12)	Documentation (7)		
	Problems associated with current variation order management.	Poor change management (15)	Poor co-ordination and communication (12)	Lack of written contracts (10)	Change in one discipline affects others (9)	Late design changes (8)	Bureaucracy of public clients (11)	Shortage of training courses for engineers (8)
Existing models/ frameworks to manage variation orders in Saudi public construction projects.	Using models/ frameworks to manage variation orders.	Currently no existing approach (18)	No idea about how these work (12)					
	Causes of not using models/ frameworks.	Lack of awareness (10)	Lack of knowledge (9)	Assuming that it is complex (8)	Lack of sufficient contracts (7)	Lack of experience with change management (8)	Assuming that it is costly (9)	Not enough details are produced in the design(9)
The need for variation order management systems.	Significant need (17)	Analysing variation order comprehensively (13)	Leading for effective design (12)	Better understanding of variation orders (14)	Assists with better management (14)	Avoiding unforeseen design errors (11)		

* The frequency of the key finding by the respondents

It can be seen, from the analysis of the exploratory interviews, that the tasks of the parties involved in construction projects at the design stage in Saudi Arabia are not yet clearly identified and understood with regards to variation order management. This issue could be attributed to the fact that there are currently no formalised approaches to manage variation orders during the design process. This conforms to the results obtained by Almazayad (2009), who carried out a study in which he states that the tasks and activities of construction projects in Saudi Arabia are not yet well explained and identified among the project parties. Moreover, it can be clearly seen from the interviewees in the public sectors that the scope of any construction project is not clear enough for the public clients, notably with regard to project variations. Here, the considerable lack of knowledge in relation to change management practices can be clearly noticed. This finding adds weight to Al-sudairy's (2001) argument, which states that the system of change management is new in the Saudi construction sector and is not yet well established.

Analysis of the data also revealed a significant lack of knowledge and experience with the management of change orders in Saudi construction projects, which led to several problems that could easily be associated with variation orders. Such a result agrees with Alkhalil and Alghafly (1999), who claim that changes are one of the major causes of delay in the Saudi construction industry. Similarly, the survey conducted by Al-sultan (1989) identified that there is no systematic engineering approach, or at least no formal procedure followed by the public sectors in Saudi Arabia, in order to set the contract duration for the public construction projects. Hence, participants in the current study, both public clients and consultants, strongly suggested a need for adopting a change order management system at the design stage to assist them in overcoming problems and managing changes effectively. Additionally, participants suggested some further issues must be taken into consideration before applying a change management system in the Saudi construction industry. These suggestions are, for instance, providing workshops and training courses to the project parties to understand how these systems work, having full awareness of the variation order process, paying more attention to contract terms and improving the communication and co-operation between project teams.

CONCLUSIONS

This paper investigated the current practice of variation order management in Saudi public construction projects at the design stage by carrying out exploratory interviews among public sector clients and consulting firms. The results of the exploratory interviews indicated that there are currently no formalised approaches to the management of variation orders at the design stage. The paper concludes that there is a need to apply an appropriate variation order management system to Saudi public sector construction projects. In addition, this paper presents some of the participants' suggestions.

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