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The American University in Cairo

School of Science and Engineering

Management of Change Order Claims in the
Egyptian Industrial Construction Sector:
Analysis and Means of Improvement

**A Thesis Submitted to the
Engineering Department**

In partial fulfillment of the requirement for
The degree of Master of Science

By

Waleed El Nemr
Bachelor of Science in Construction Engineering

Advisor : Dr. Amr Hassanein

May 2001

**Management of Change Order Claims in the Egyptian Industrial
Construction Sector: Analysis and Means of Improvement**

A Thesis Submitted by
Waleed Mostafa El-Nemr

to the Interdisciplinary Engineering Programs

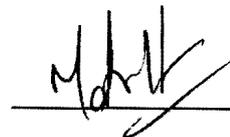
May 27, 2001

in partial fulfillment of the requirements for the degree of

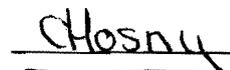
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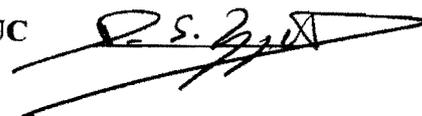
Dr. Amr Hassanein, (Advisor)
Associate Professor, Construction Engineering Department, AUC



Dr. Osama Hosni
Associate Professor, Helwan University



Dr. Ahmed Samer Ezeldin
Associate Professor, Construction Engineering Department, AUC



Dr. Edward Smith
Acting Director, Interdisciplinary Engineering Programs AUC




Department Chair/
Program Director

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Date


Dean

June 5, 2001
Date

ABSTRACT

The term claim has become a word of paramount significance on construction projects worldwide. Throughout the past decade, several research works in Europe and North America have been dedicated to exploring the causes of claims and solutions that would help minimize their occurrence and possibly prevent them. This research is the first of its kind in Egypt, as it attempts to help gain a deeper insight of the status of claims management from the contractors perspective with respect to the Egyptian industrial construction sector. Special attention is given to change order claims, as this research demonstrates them as a major cause of claims in this sector. By the end of the research, strategies for improvement of change order claims management, and hence claims management in general, would be furnished.

Claims management in the Egyptian industrial construction sector has been proven to suffer from a variety of pitfalls, including lack of proper notification procedures in public contracts and poor documentation management. This lack of proper documentation management has led over 50% of the sample projects to not obtain change orders, to which they assumed they were entitled. Nearly 30% of the sample projects within this research stated that site personnel must be fully aware of all contractual requirements in order for documentation in the Egyptian industrial sector to be improved. Moreover, the basic cause of change order claims has been documented by nearly 70% of the sample projects to be additional scope of work, which can be attributed to the simultaneous progress of the design and construction works in such a fast track sector. This simultaneous progress results in the owner awarding the contractor additional work during project execution that was not conceived at the beginning of the project prior to contract award. One of the most

important conclusions of this research is that it was reported that many Egyptian owners and designers were offended from prompt claim notification and documentation procedures on part of the contractor.

Suggested means for improvement include addressing the issue of the owners' offense from prompt claim notifications by the formation of a unified form of conditions for the Egyptian industrial sector. It is suggested that this form of conditions would be enforced by a professional engineering organization of significant authority and jurisdiction within Egypt. Another suggested means of improvement addresses owner-caused delays and suggests that the owner and contractor both share the float associated with the delayed activity through a float-sharing provision in the contract. Finally, the use of information technology systems instead of traditional filing procedures has been suggested as means to improving documentation practices within the sector.

CHAPTER 1 : INTRODUCTION AND LITERATURE REVIEW

1.1 Introduction

This chapter first introduces the concept of claims management, then takes a closer look at one of the most common types of claims, namely change order claims. Attention is then focused on the nature of industrial projects in general and the effects that change order claims have had on them, as published in accredited construction management journals. The chapter then introduces the nature of the Egyptian construction industry and the most common problems facing it as a foundation for the propagation of change order claims. Finally, the chapter concludes by the thesis composition section, where the problem statement and objectives of this research are defined.

1.2 Claims : A General Perspective

1.2.1 Definitions

The term “claim” has become a commonly used word in the construction industry around the world. In fact, it has been reported that disputes that occur in construction projects are continually increasing in the industry (Zack 1993). Over the years, there were various attempts to define the term “claim”. There were those who defined a claim in terms of its relation to the original contract. Semple et al (1994) defined a claim as “an assertion to the right to remedy, relief or property” or as “a failure to fulfill obligations

under the contract”. Jergeas and Hartman (1994) defined a claim as “any application by the contractor for payment that arises other than under the ordinary contract payment provisions”. A more elaborate definition has been provided by Hughes et al in their reference *Claims in Perspective*, where they defined a claim as “a request, demand, application for payment or notification of presumed entitlement to which the contractor, rightly or wrongly at this stage, considers himself entitled and in respect of which an agreement has not yet been reached” (Hughes et al, 1992).

1.2.2 Reported Causes of Claims

Several studies were conducted to arrive at the main causes for claims. In a study conducted on 24 construction projects in Western Canada, it was shown that the main causes of claims were the following (Semple et al, 1994) :

- Change orders, such as increase in scope, design changes, extra work and errors (20 claim reports).
- Severe weather conditions, such as cold conditions that affected the ability to do the work (8 claim reports).
- Restricted access – which refers to the non-availability of the work area due to reasons of it not being ready for work to be carried on (7 claim reports), and
- Acceleration – which refers to the attempts to mitigate delay by an increase in resources (6 claim reports).

Authors Jergeas and Hartman (1994) stated that previous research conducted by Deickmann and Nelson in 1985 concluded that 72% of contract claims are due to change orders. Other factors recorded by Jergeas and Hartman (1994) include inadequate bid

information, faulty or late supplied owner material, poor quality of contract documents (drawings, specifications, etc...), lack of coordination, and others.

1.2.3 Effect of Claims on Time and Cost of a Project

Claims have been reported to have a significant effect on the total cost and duration of any project. This fact can best be demonstrated by the results of a survey conducted on 24 construction projects in Western Canada, the results of which are shown in figures 1-1 and 1-2.

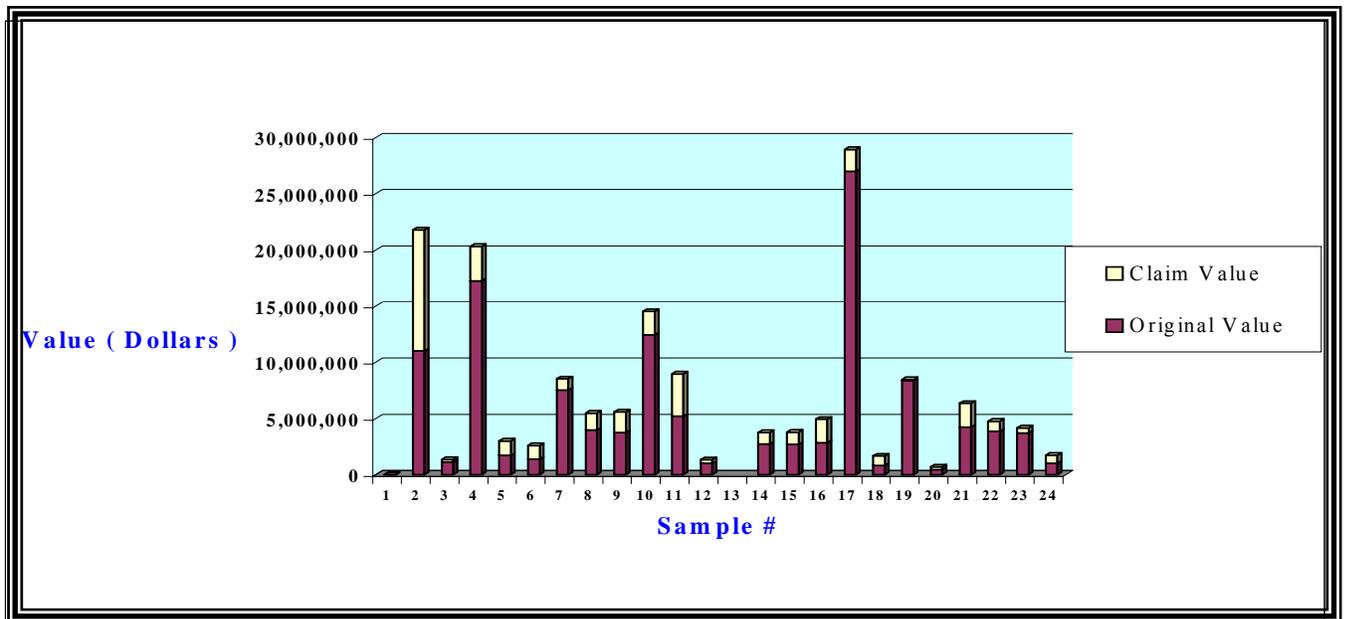


Figure 1-1 Impact of Claims on Total Cost of Project (Semple et al, 1994)

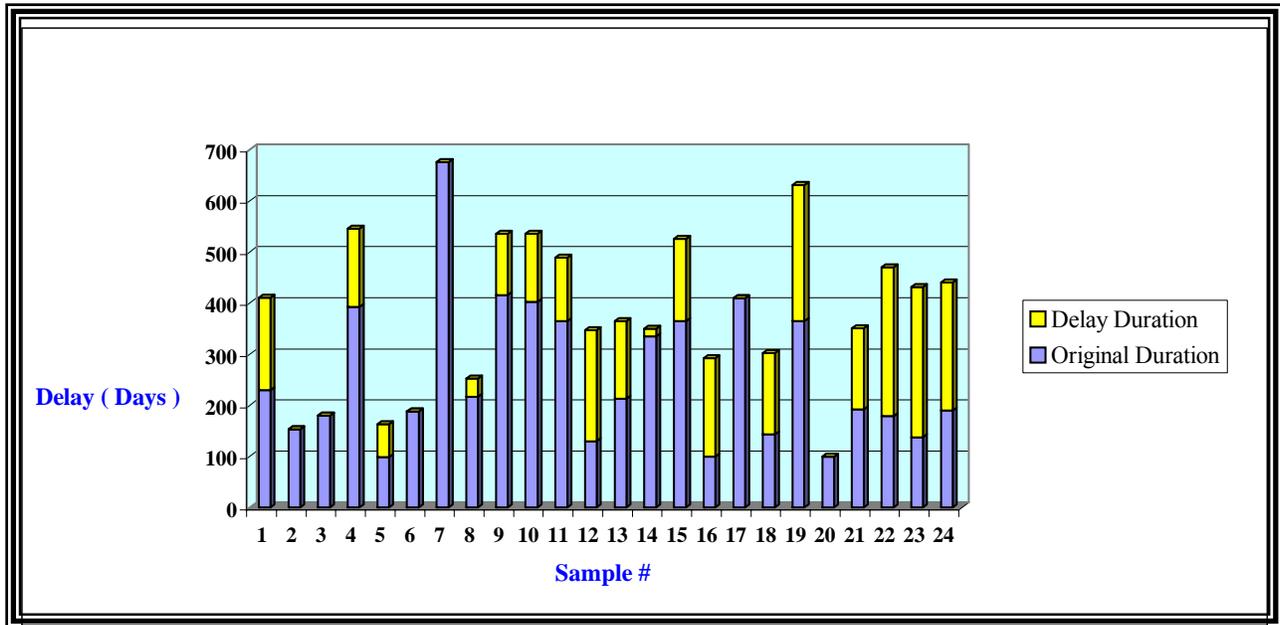


Figure 1-2 Impact of Claims on Project Duration (Semple et al, 1994)

The total value of the projects under study was \$ 124 million and the total amount of claims led to \$ 50 million, thereby leading to a 40% increase in project cost. Similarly, the total durations of the projects under study were 6,180 days and the total delays caused by claims reached 2,955 days, thereby leading to a 48% increase in project duration. A closer examination at figures 1-1 and 1-2 shows that 30% of the projects led to claims that culminated in delays exceeding the contract duration by 100% (Semple et al, 1994). In terms of values, this study also revealed that more than half of the claims led to a cost increase of at least 30% of the original contract value, while at least one third of the claims led to an increase of at least 60% of the original contract value (Semple et al, 1994).

1.2.4 The Art of ‘Claimsmanship’

As a result of the significance of claims on the values of a project, a new project management tactic was developed – namely that of the management of claims, or as James Zack (1993) named it: the art of “claimsmanship”. In this interesting article, the author presents several tactics or legal maneuvers that contractors and owners use to gain the upper hand and win claims without actually violating the contract terms (Zack, 1993).

Among the practices used by the contractors were the following:

- Reservation of Rights : In this approach the contractor’s target is to reserve his rights for any change order or claim at the time of the change and leave the settlement to this claim at the end of the project. Although this is a procedure that can be used to better improve the management of claims in a project (Jergeas and Hartman, 1994), this procedure makes it possible for the contractor, near the end of the project, to make up for any losses that have been incurred in the project by filing delay, damage, or disruption claims (Zack, 1993). Hence, the contractor promptly reserves his rights to claim and presents a detailed account of the claim only at the end of the project, where he can take advantage of any losses and delays and incorporate them in his claim.
- Total Cost Claims: This claim is also referred to as the “global claim” or “rolled-up claim” in the UK (Vidogah and Ndekugri, 1997). The way in which this type of claim is presented is that at the end of the project, the contractor deducts the approved change orders and the base contract amount from the actual costs. The

result is argued by the contractor to be the impact costs that would not have been present if it were not for the actions of the owner (Zack 1993).

- Hail Mary Change Order: In this type of claimsmanship, the contractor is the one experiencing a delay. However, once a last-minute change order is issued, the contractor magnifies its effect in order to cover for his delays. The author reported that some contractors even demand compensation for the delay (Zack, 1993).

A tabulated presentation of all the forms of contractor claimsmanship as outlined by Zack (1993) is shown in table 1-1.

1.2.5 Proposed Solutions

Throughout the majority of the research that was conducted on claims, solutions were always sought as an attempt to minimize claims to the extent possible. Based on an analysis of the literature review, the proposed areas for improvement can generally be divided into the following categories:

- Contract Management
- Planning and Scheduling
- Documentation and Record Keeping

1.2.5.1 Contract Management

It has been pointed out by Jergas and Hartman (1994) that most contractors are not

Table 1-1 Forms of Contractor Claimsmanship (Zack, 1993)

No.	Claimsmanship Type	Claimsmanship Description
1	Bidding Tactics	Contractor bids alternate equipment or materials in the bidding stage so as to obtain a competitive advantage at the beginning and also claim for equitable adjustment during the project.
2	'Bid your claims' Approach	The contractor presents two bid takeoffs: Typical bid estimate An estimate of the deviations that could occur in plans and specifications, and that could eventually be used to the contractor's advantage.
3	Project Float Claims	Asserting that the float belongs solely to the contractor, the contractor claims for not only the direct and indirect costs of the change order – but also the time expended in performing the change in order to restore his float.
4	Delayed Early Completion	Even though the contractor may complete his project ahead of schedule, he contends that if it were not for the delays of the owner, he would have completed earlier.
5	Accelerated Delay Claims	In the case the contractor has been granted acceleration beyond the original contract completion date, and in case the contractor completes the works ahead of the acceleration target: Contractor claims the time expended in performing the acceleration Contractor claims the costs of acceleration for the entire acceleration period, even though he only utilized part of it.
6	Loss of Productivity/Efficiency Claims	Contractor claims for loss of efficiency or productivity suffered due to owner's changes
7	Total Cost Claims	Contractor claims the difference between the actual project costs and the original project costs + agreed-on change orders: Total Cost Claims = Actual costs – (Base contract + agreed-on change orders)
8	Cardinal Changes	Contractor claims that the changed work was of such magnitude as to alter the originally agreed scope of work.
9	Disadvantaged-Business-Enterprise (DBE) Claims	Due to the owner's requirement of DBEs in the contract, the contractor claims all costs associated with damages caused by DBE subcontractors, although they are under his supervision.
10	Hail Mary Change Order	A contractor in delay or loss at the end of the project waits for last-minute change from the owner to claim delay and cost compensations.

aware of the contents of their contracts prior to the bidding process and even more contractors are not aware of their contracts requirements even during the execution phase. It is not before a claim case arises that attention is given to contract interpretation. Hence, the authors call for the contractor site managers to make themselves aware of the contract contents and to make a checklist that incorporates all contractual requirements at various stages of the project. Moreover, during the process of reviewing the contract itself, the interpretation process has become an area requiring special attention. In his article “Interpretation of Construction Contracts”, Thomas et al (1994) concluded that it is part of the contractor’s pre-bid role to inquire about any ambiguities present in the contract so as to prepare a bid that takes these ambiguities into account. The authors add that if the contractor consents to the owner’s interpretations, then he cannot claim a different stance later.

Furthermore, a significant number of contractors do not quote a contract clause when preparing a claim, as stated in various research studies including Jergeas and Hartman (1994) and Vidogah and Ndekugri (1997). This fact can be assumed to stem from their lack of familiarity with the contract and its relevant clauses to the claim matter. Research in the area of claims preparation for arbitration concluded that it would be difficult, if not impossible, to validate a claim not tied to a contract clause (Gransberg and Joplin, 2000). Semple et al (1994) concluded that the most common contract clauses that were quoted in these claims were in the areas of delays, scheduling and increase in scope of work. Hence, it could be reasonable to combine the results of these articles by stating that an important area for improvement in claims management is the careful

review of the contract prior to the bidding process, then the analysis of potential problematic contract clauses, such as those dealing with delays, scheduling and increase in scope of work. It has also been suggested that at the bidding phase, the owners and the contractors should place more weight on the management systems of the contractor so as to agree on potentially disputed issues that might evolve during the execution phase of the project, such as head office overheads, profits and unit costs of key resources (Vidogah and Ndekugri, 1997).

1.2.5.2 Planning and Scheduling

This topic has become the heart of numerous research efforts and studies. As planning and scheduling is described by Jergeas and Hartman (1994) as the “backbone of the whole project”, it is an essential tool for the improvement of the status of claims management for contractors. Semple et al (1994) recommends the use of scheduling as a monitoring and detection tool, as it can be used to monitor the progress of a project, and at the same time, to detect any deviations in the productivity and/or costs that may result from a claim matter. Running along the same track as Semple’s, other research works were aimed at quantitatively measuring the effects of a change order claim by comparing an updated schedule to a base-line schedule, and then generating a procedure so as to evaluate and present the alterations in the schedule (Veenendal 1998).

1.1.5.3 Documentation and Record Keeping

Adequate documentation and record keeping is probably one of the most common problems facing the proper management of claims. Almost all of the research performed in this area state that this problem stems from the lack of weight that the contractor site

representatives give to documentation management. Some of the most common documentation problems are the result of neglect of notification procedures within the contract, the carrying out of extra work without written authorization, change orders not being described and tied to a contract notice (as described in the previous section), minutes of meeting not being commented on in writing, letters not being answered when objected to, important telephone conversations not being confirmed in writing and non-contractual verbal instructions by the owner not being officially validated (Jergeas and Hartman, 1994). These facts that are becoming increasingly more common have compelled various research efforts to be conducted in the area of improving records management. Hamilton (1991) urges engineering firms to implement a full records management program in their firms, with the aid of organizations and/or consultants working in that field, if necessary. In a study conducted in the UK that targeted consultants' opinions as to the areas requiring improvement in claims management from the contractors' part, 'inadequate information' was one of significant reasons for consultants' rejection to part or all of contractors' claims (Vidogah and Ndekugri, 1997). Among the recommended solutions to this problem is the filing of potential claim matters after making written notices within the time frame stipulated in the contract (Jergeas and Hartman, 1994), and the use of electronic document management systems (frequently used by insurers and banks) as a means to allow access by subject matter to information stored in different forms with minimal transaction costs (Vidogah and Ndekugri, 1997).

1.3 Change Order Claims

One form of claims that has been given significant attention in claim research within the last decade is that of change order claims. Change order claims can be defined

as “written authorization provided to a contractor that approves a change from the original plans, specifications, or other contract documents, as well as a change in the cost” (Hanna and Russel, 1998). Generally, an owner is entitled to changes during the project execution. However, the contractor, having carried out these changes, is entitled to a fair compensation for the work performed that was not in the original, planned schedule of works. Disputes arise at this point due to the owner’s conviction that the contractor is requesting more than he deserves for direct changes to the work, and to the contractor’s notion that he is not being fairly compensated for the work performed, which negatively affect his work progress. The topic of change order claims has been one of the most commonly discussed forms of claims in the past decade. Some of the most commonly discussed angles of change order claims are their effect on labor efficiency, and the quantification and qualification of these claims.

1.3.1 Effect on Labor Efficiency

Several research studies have attempted to describe and quantify the effect of change orders on labor efficiency. A study reported by Thomas and Napolitan (1995) covered three industrial projects in the United States, namely a process plant, a paper mill and a refinery. The results showed that it is possible to perform changes without actually negatively affecting the efficiency, as no negative effect was observed in more than half of the days when the changes occurred. However, the highlight of that research was that, on average, a 30% loss in efficiency was observed due to disruptions in the work progress. Disruptions caused a range of 25-50% loss of efficiency.

Other research works have attempted to quantify the effect of change orders on labor efficiency by developing formulae that are a function of a variable, “delta”, which

was defined as the difference between the actual hours and the change order hours incurred in a certain work performance. This research includes the chain of studies performed by Hanna et al encompassing the effect on electrical construction labor efficiency (1998 & 1999a) and that on mechanical construction labor efficiency (1999b).

1.3.2 Quantification of Change Orders

As mentioned previously, the adverse effect of change orders for the client vis-a-vis the contractor may result in rising tensions throughout the project. One factor that escalates these tensions is the quantification of change orders. Most of the times, disputes arise due to the absence of a unifying and mutually agreed upon method for quantifying changes that occur in the project. To resolve this dispute, several research studies have been aimed at arriving at a systemized method for the calculation of costs that result from change orders. For example, in his article “Quantifying Costs due to Change”, Fourie (1993) outlines several formulae to be used for varying types of costs, all of which would be affected by the change. The outcome of the formulae is new rates that are to be agreed upon with the owner or the engineer. In the end of his article, Fourie states that agreeing on these formulae and resulting rates can help decrease the tension between the parties as the engineer would know the expected cost of the change and the contractor would not fear being underpaid after performing the change.

Another form of quantification of change orders is that outlined by Veenendal (1998), which is based on analyzing the effect of change orders on a project schedule. Basically, the author calls for an impact analysis of every change order on the project base schedule by recording it on an updated impact schedule, then presenting the impact on a Change Order Summary form, attached with the change order impact schedule, to be

submitted to the owner for approval. This form of monitoring would constantly keep all parties alert to the impact of the change order on the project completion time and would pave the way for cost negotiations later on. While Veenendal (1998) provided a clearly defined proposal for carrying out this planning monitoring procedure, the basic idea of using scheduling as a tool for periodically stressing the impact of changes had been emphasized earlier by Semple et al (1994) and Jergeas and Hartman (1994).

While most research work performed in that area targeted the quantification of direct costs, few did target the indirect cost calculations. Bower (2000) outlines a mechanism that utilizes influence lines to calculate the indirect costs as a result of a variation order. He concludes his research by the same ideas, which Fourie (1993) stated that emphasized the positive effect of utilizing these formulae and the systematic approach of costs calculations on the team work among the various parties in a project.

1.3.3 Qualification of Change Orders

Qualification of change orders is another important dimension of change order claims management that has been the focus of many research works' attention lately. However, this point has not been given the weight it deserves from the contractors in the construction industry. According to the conference on claims management presented by Dr. James R. Knowles (1993), it has been proven from various judicial rulings that a contractor or subcontractor who fails to serve a proper claims notice will lose his rights. In addition, Knowles stated that it has been noticed that from time to time contractors have failed to comply with the claims notice requirements under the contract, which prevents them from presenting their claim under the contract. Other research, such as that of Jergeas and Hartman (1994), call for proper qualification of change order claims

notices by emphasizing the effects of costs other than direct costs. The research performed at quantifying indirect costs (such as that by Bower (2000) and Fourie (1993)) and labor productivity impacts (such as those by Thomas and Napolitan (1995), and Hanna et al (1998, 1999a and 1999b)), further supplement Jergeas and Hartman's emphasis on the importance of such costs. In addition, Jergeas and Hartman call for proper quotation of the reservation of rights notice so that all extra costs other than the direct costs would be preserved, by quoting phrases recommended by two lawyers in Canada (Jergeas and Hartman, 1994).

Other lawyers have tried to emphasize the importance of the qualification of a claim matter at arbitration by stating that as a rule of thumb, "if the issue at point cannot be tied specifically to a contract clause, it will be difficult, if not impossible, to prove the merit of the claim" (Gransberg and Joplin, 2000). The authors further warned from "information overkill" as contractors normally focus more on increasing the volume of costly and unnecessary documentation than on the preparation of properly qualified claims material. The authors then provide the guidelines for a better presentation of the claim matter during the process of arbitration.

1.4 Change Orders in Industrial Projects

1.4.1 Industrial Projects : An Overview

The industrial sector in particular can be described as one of the areas most susceptible to changes and claims. It had been reported through research works conducted in 1983 that on site construction activities in industrial projects were perceived

to be the most troubling in terms of quality of the work performed (Burati, 1992). Time is money and it is the most important resource that owners can acquire. Therefore, construction buildings in heavy industrial projects worth billions of dollars and that need adequate time for the design and execution phases can commence as the design phase is still ongoing, thereby leading to incomplete and inaccurate designs (Hanna et al 1999b). The result is an ongoing flood of claims and a project budget (and schedule) that is never satisfied. Although the literature available that demonstrates the relation between industrial construction and change order claims is minimal, several research works demonstrate that the ultimate effect that change orders have on industrial projects is best presented in terms of quality and loss of labor efficiency.

1.4.2 Effect of Changes on the Quality of Industrial Projects

The above-mentioned effects can best be demonstrated in the research performed by Burati (1992) on nine fast-track industrial projects in the United States. This research focused on five different types of deviations and their effect on the projects in question:

- 1 *Design deviations:* These are related to the design of the project.
- 2 *Construction deviations:* These are related to the construction phase of the project and consist of the activities and tasks that take place on the construction site.
- 3 *Fabrication deviations:* These deviations are related to shop fabrication, and are the result of mistakes by vendors, suppliers, or fabricators.
- 4 *Transportation deviations:* These are related to the transport of materials, equipment or supplies.

5 *Operability deviations:* These are related to the improvement of the operations in the project, such as the use of two pumps instead of one, or the installation of a check valve in a required pipeline.

The results of this research can be summarized in the following points:

- Design deviations accounted for 67-90% of the total number of deviations in the project, whereas construction deviations ranged from 5-29% of the total number of deviations.
- Design changes resulted in the greatest number of design deviations (on average 13%).
- Upgrade type of projects on existing industrial buildings had the highest percentage of design deviations.

1.4.3 Effect of Changes on Labor Efficiency

The effect of changes on labor efficiency is probably the most discussed type of change that impacts industrial projects. In a research conducted by Thomas and Napolitan (1995) on three industrial projects constructed in the early 90's, it was reported that on average there is a 30% loss of efficiency when changes are being performed. It was also stated that it is possible to perform changes without causing any decrease in labor efficiency. It was concluded that the key factor of the impact on efficiency is the time of the change. This conclusion is in harmony with another research conducted on labor for mechanical construction, where it was proved that the later a change occurs in the project the higher the impact on the labor efficiency (Hanna and Russel, 1998). It had also been documented by Thomas and Napolitan (1995) that the key impact factor of change on labor efficiency are the disruptions caused to the work. The most significant

types of disruptions were found to be lack of materials and information, and out-of-sequence work. These disruptions resulted in a daily loss of labor efficiency in the range of 25-50%. In agreement with these results was a research aimed at utilizing neural networks for estimating concrete productivity, whereby it was stated that the non-accessibility of materials on site can lead to a 40% loss in labor productivity (Sharara, 2001).

Other research works targeted developing models that more accurately quantify the effect on labor efficiency. Most of these research works were conducted on mechanical and electrical labor forces. One reason for this is the interdependence of the two trades. However, it has been reported that losses in productivity as a result of change orders are not affected by the type of construction – whether it is general building or industrial construction (Hanna and Russel, 1998).

1.5 The Construction Industry in Egypt

1.5.1 The Construction Industry : An Overview

Among the various economic sectors in Egypt, the construction industry is one of the fastest growing and most dynamic. It has been documented that the construction sector has been growing at an average rate of 25% annually (Winthrop Corporation, 1999). The construction sector, as a whole, experienced a different turn in 1995 as private sector construction witnessed a remarkable increase in terms of resorts on the Red Sea, Sinai and North coasts. This has led to an increasing demand for materials and engineering services from the United States and elsewhere around the world, including

France, Germany and Spain (Winthrop Corporation, 1999). This competition was not restricted to tourist resorts alone, but rather, it extended to industrial construction as most Egyptian owners resorted to foreign companies to manage and construct their projects. It was noticed, however, that Egyptian construction was lacking significantly as far as quality is concerned (Abdel Razek, 1998). Research centering on this topic shall be discussed in the subsequent section.

1.5.2 Characteristic Quality Problems

As may be expected, academic literature regarding the characteristics of the construction industry in Egypt is scarce. However, one piece of research was conducted on one of the largest contracting companies in the Middle East, the Arab Contractors, that involved the participation of 90 construction managers (Abdel Razek, 1998). The result of this research was the development, using Pareto analysis, of 16 factors required to improve quality in their projects – each factor being assigned a relative importance percentage. Two of these factors could lead to significant change order problems. One of these factors is the improvement of estimating and tendering departments, having an importance factor of 7.4%. The significance of this factor on change order claims is that poor tendering procedures can lead to change order claims in the form of extra work during the actual execution phase of the project. The second factor is the improvement of documentation, communication and information systems, having a relative importance weight of 1.54%. The improvement of documentation and information systems in a construction entity is one of the key issues for the improvement of claims management. Poor documentation methods used in the Egyptian construction industry have led to mounting problems and to the loss of millions of Egyptian Pounds for a great number of

projects throughout the years. In general, the main categories for the improvement of quality management as reported by Abdel Razek (1998) are shown in figure 1-3.

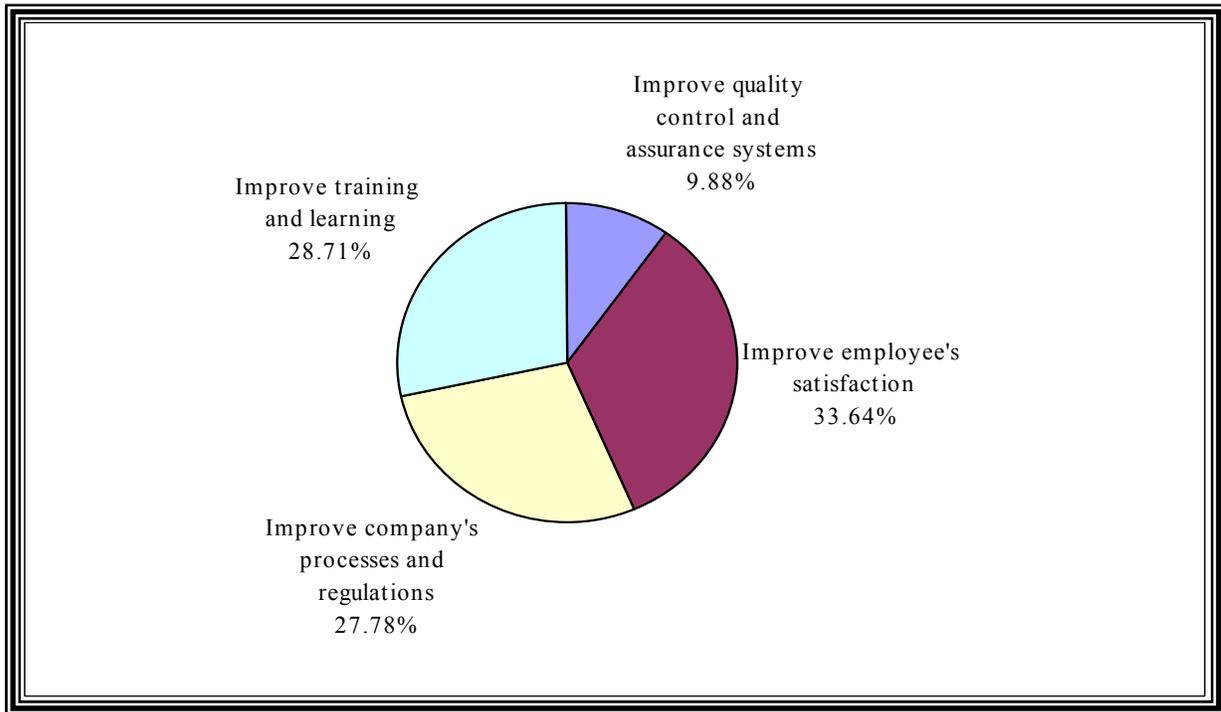


Figure 1-3 Quality Improvement in Egypt : Main Categories (Abdel Razek, 1998)

1.6 Thesis Composition

1.6.1 Problem Statement

It is evident from the above presentation that extensive research on claims within the past decade focused primarily on the problems facing claims management and the means for improvement. Whereas the majority of these research studies took place in

Europe and North America, research of this kind was seldom conducted in developing countries, although the frequency and level of intricacy of claims is just as alarming in the latter, if not more.

In Egypt, claims management is gaining more importance than before. This is due to the opening up of the economy of the country through the recent policies of moving towards a decentralized system and through privatization of major sectors of the economy. This in turn led to more contact with multi-national construction companies that use claims as an important tool for the maximization of profit. Industrial projects by their nature experience significant claims and disputes, and claims management for these projects is essential (Burati, 1992). Several questions emerge along these lines; what is the status of contractors' claims management of industrial projects in Egypt? What are the main causes of change order claims that Egyptian contractors face in industrial projects? What are the factors associated with cost and time increases in industrial construction projects in Egypt? How can the problem of claims management, especially change order claims, in Egyptian industrial projects be improved?

It is the answer to these questions and the lack of research in this area that created the need to conduct this study which targets middle to large-sized Egyptian contracting companies working in industrial projects. This study focuses on a better understanding of the status of general claims and change order claims management as well as the causes of change claims in industrial projects in Egypt, and the factors associated with cost and time overruns. Finally, after this information is obtained and analyzed, this research provides suggestions for improving the management of these claims.

1.6.2 Purpose Statement

The purpose of this research is to explore the status of contractors claims management in the Egyptian construction industrial sector, and to understand the causes of change order claims within this sector and the factors associated with cost/time overruns. Finally, after achieving the aforementioned objectives, suggestions for improvement can be developed.

1.6.3 Thesis Composition

The first segment of this research is a comprehensive literature survey that introduces the reader to the most discussed topics in construction claims management within the past decade. This discussion is based on publications made in some of the most accredited construction management journals. The purpose of the literature review is to introduce the topic of change orders claims management in the Egyptian industrial construction industry through a sequence of phases. First, a general introduction to claims management is furnished then the literature review moves to the most demanding topics in change order claims within the past decade. The following phase focuses on change order claims in the industrial sector. Finally, the literature review focuses on the characteristics of the Egyptian industrial sector. At that point, the need to conduct the research is explained through the problem statement, and the purpose statement is made.

The procedures that were used to fulfill the four research objectives form the following section, the research methodology. This is conducted through a series of steps. The first is a detailed description of the four research objectives. The following segment forms the heart of the research methodology section as it incorporates the steps followed while conducting the research. A procedure outline explains the steps followed

throughout the research, starting from the formulation of the research objectives and ending with the formulation of the results and conclusions. In addition, the sampling criteria and validation is explained. Finally, the research methodology section concludes with the means by which the questionnaire was formulated.

The third segment of the research, the results and analysis, provides an analysis of the answers obtained from the various respondents to the research questionnaire. The results and analysis are aimed at fulfilling each of the four objectives.

Finally, the research concludes with the summary and conclusions section, which provides a brief outline of the important information within this research. This section is followed by the limitations and suggestions for future research.

CHAPTER 2 : RESEARCH METHODOLOGY

2.1 Introduction

This chapter introduces the research tools and procedures used. First, the research objectives are outlined. The following section, the research methodology, is the heart of this chapter, as it describes the five main components leading to the completion of the research objectives. The first of these components is the research procedure outline. Then the sample criteria and the means of calculating the sample size are explained. The third and fourth components describe the data collection methods and the procedure for the formulation of the research questionnaire. The final component is the methodology of the data analysis, which provides the framework for the subsequent chapter.

2.2 Research Objectives

The objectives of this research are set to explore the various factors affecting Egyptian claims management for industrial projects. A special emphasis is made on change order claims, in order to give an insight on their status in the Egyptian industrial sector within the past decade and, subsequently, to pinpoint areas that need improvement. The means to fulfill these objectives can be achieved by the formulation of a questionnaire that reflects the main obstacles facing proper claims management that have been noted in the literature within the past decade. Although the questionnaire composition shall be discussed thoroughly in a subsequent section of this chapter, this section serves to briefly highlight the various areas of claims management that will be

covered for each objective.

Objective 1 : To define the status of claims management, in general, and change order claims management, in specific, with respect to contractors operating in the Egyptian industrial construction sector.

The literature survey conducted pinpointed several key areas, which this research shall utilize, that can be used to assess the status of claims management, in general, and change order claims, in specific. Although the majority of the literature review focuses on claims management in various industries (including the industrial sector), this research shall take into account the key areas of discussion within the literature review and apply them to the industrial sector. The key areas to assess claims management in general are the means by which the notification for claim processes is handled and the procedures of documentation and filing. The key areas to assess change order claims management is the frequency of oral change orders and how they were handled. Also of importance is the availability of an agreed base for change order quantification, as shall be discussed later.

Objective 2 : To determine the main causes of change order claims in the Egyptian industrial construction sector

Prior to this question, this research shall aim to gradually emphasize the weight of change orders by understanding the frequency of their occurrence with respect to each of

the sample projects. Then the main cause of change order claims shall be chosen by the respondents for the sample projects through a multiple choice list incorporating the most noted change orders causes mentioned by several authors in accredited journals.

Objective 3: To identify the factors associated with project cost and time increases within this sector

This objective aims at gaining a better understanding of the cost and time increases in projects and the factors associated with these increases. This shall be obtained through analyzing the general project information, such as the contract type, contract conditions, ownership, and so forth. This project information is then linked to the cost and time increases in a project. At that stage, a conclusion can be made as to what type of contract is associated with most time and cost increase, or what type of project ownership experiences the most time and cost increase, and so on.

Objective 4: To generate means of improvement regarding the problematic areas outlined in the results of the previous three objectives

The remaining objective of the research serves to pinpoint areas that require attention and that can form grounds for improvement. This will be achieved through applying solutions generated in the literature review, wherever possible, to these areas so that suggestions for improvement may be attained.

2.3 Research Procedures

2.3.1 Procedure Outline

1. Formulate Research Objectives and Problem Statement:

A literature review was conducted on construction claims to narrow the topic of research. It was after this second literature research (the first was made in order to arrive at the general area of study – claims management) that the area of claims in industrial projects was selected, emphasizing change order claims. Industrial projects were selected as the focus of claims study mainly, among other factors, due to the author's work experience, which included claims management activities of cement plant projects in Egypt. Indeed, this experience encouraged the author to realize that research on claims, especially change orders, of such a fast track sector may be the ideal means to evaluate the subject matter at its peak. At that point, the research objectives and problem statement were then formulated, as per section 1.6 of this thesis.

2. Construct Research Questionnaire:

After formulating the main objectives of the research and demonstrating the need for it, the questionnaire formulation process was then initiated. The third and final research literature survey was conducted to arrive at the most demanding issues discussed within the past decade on the topic of claims management in general, and change order claims, in specific. As mentioned earlier, the literature review incorporated articles that focused on the topic of claims and change orders in various industries and not just the industrial

sector to gain a broader perspective of the factors that might affect claims management and apply it to the industrial sector. The outcome of this research was the development of several questions that would accomplish the objectives set, each question having its own referenced document support.

3. *Conduct Interviews with Personnel in Target Companies:*

Once questions had been formulated, the next step was to select the companies that fit the criteria of this research. Companies were selected according to the principle of *purposeful sampling*, which shall be discussed in the next section of this thesis. Appointments were then made and interviews conducted with engineers or managers in large Egyptian construction companies operating in the industrial sector who handled claims issues in various heavy industrial projects. A file that contained all the article sources of the interview questions was made available during all the interviews and was presented, when necessary, to the respondents so as to emphasize the importance of a research question or for additional clarification. This procedure was adopted so as to cause the respondent to sense the importance of the research at hand. The respondent was given a copy of the research question while the interviewer was documenting the answers on a separate copy. After the interview was completed, the documented responses were re-written on the same day for more clarity and to include any remarks that might have been missed for shortage of time during the interview.

The respondents were chosen in accordance to certain criteria that were reflective of that used in the literature review articles. Although the majority of the articles did not specify the position and experience of their respondents (they would be referred to most

of the time as just ‘contractors’) some articles carried on a certain trend. For example, Abel Razek (1998) relied completely on construction managers for the development of his research. Hanna and Russel (1998) based their data acquisition on the contractors with significant years of successful experience. Furthermore, articles in which Randolph Thomas was involved did not address the type of respondents selected. However, it is apparent from the considerable legal flow of information that the respondents involved could only have been engineers who have considerable knowledge in contract administration. This is apparent in his articles “Interpretation of Construction Contracts” (Thomas et al, 1994) and “Legal Aspects of Oral Change Orders” (Thomas, 1991). Vidogah and Ndekugri (1997) demonstrated a deviation from the trend as they have shown that project quantity surveyors had a significant effect on the completion of the research questionnaire. As a result of the above information from the literature review, the respondents of this thesis had to be reflective of those used in the literature review. This was achieved in the sense that most of the respondents had above 15 years of experience in the Egyptian construction sector, a considerable portion of which was in the industrial sector. Also one technical office engineer was selected in the research (in harmony with the findings of Vidogah and Ndekugri (1997)). Carrying along Randolph Thomas’s trend, the majority of the managers chosen in this thesis held high contractual positions within the company (in addition to their having significant years of experience).

Another important characteristic of the respondents in this research is that they were all contractors. Of course, it is always better to have another party’s opinion, such as an owner or a consultant, on contractor’s claim management so that a more global and rounded opinion would be obtained. In addition, gaining opinions from different parties

does not lend itself to the biased opinion that contractors might have on their work. However, it is important to note that this research followed the general trend followed in the literature review. Although a considerable amount of the research does not state the type of respondents involved, the majority of the research works involved contractors only. The only exception is that of Vidogah and Ndekugri (1997) whose research addressed the consultant's perspective on improving the management of claims presented by the contractors in construction contracts.

Interviews for each project lasted on average a little over an hour in duration. Although the questionnaire was not initially designed to take that much time, the questions involved significant data gathering procedures on the part of the respondent. For example, there were cases where respondents had to search for project files in order to furnish the required information. In other cases, respondents would contact cost control managers in order to obtain cost and time impacts on projects as a result of claims. Similarly, there were cases when a contract manager needed the assistance of a general projects manager to arrive at answers to research questions. In addition to the above, several questions triggered the manager's need to give additional comments on questions that required only brief answers due to the importance of the question with respect to the project at hand. In light of all these factors, each interview for a sample project took a considerable amount of time to obtain.

4. Analyze the Results Obtained :

After all of the interviews were completed, the results were analyzed to pinpoint key problem areas. Basically, key trends among the results were observed and highlighted.

That is, the primary concern of the analysis was to illustrate the observed trend on groups of projects that shared similar results. This procedure shall be clearly demonstrated in the subsequent chapter of this thesis.

5. *Reach Conclusions Based on Results Obtained*

After the analysis of the results, a conclusion on the status of industrial projects claims management was reached by identifying the key problem areas in the analysis conducted on the results. In addition, the status and weight of change order claims within the industry was identified, and its main causes documented. Subsequently, the factors associated with the cost and time overruns in the sample projects were identified. It is by analyzing the results of these objectives that a solution or proposal for improvement was generated, as noted in the next and final step of the research procedure.

6. *Suggest Recommendations for Improvement of Key Problems Areas*

The final step is to generate recommendations for improvement of the identified problem areas by utilizing the results of other research studies as discussed in the first Chapter. This final section will represent the merge between conclusions of research conducted in North America and Europe on one side and this research on the other side, which should result in a practical guide to overcome claims management problems experienced in the Egyptian industrial sector.

The procedures followed in the research methodology process are shown in figure 2-1.

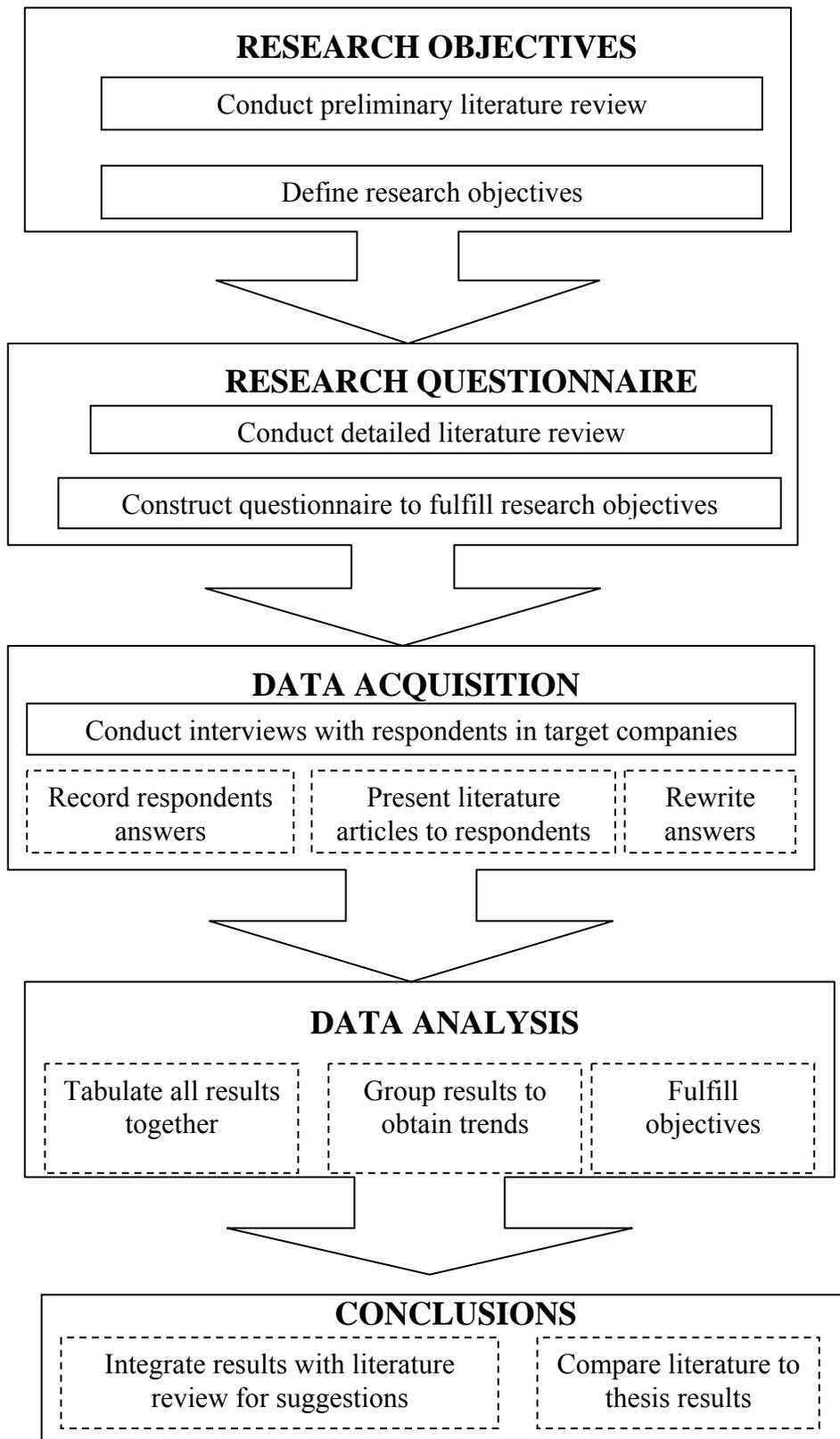


Figure 2-1 Research Methodology

2.3.2 Sampling Procedures

2.3.2.1 Sample Criteria Justification

The sample unit of this research is the projects of the companies that fit the required research criteria (as shall be discussed hereinafter), based on the premise that every project has certain parameters which in turn have a significant effect on the type of claims present. The companies from which the projects formed the sample of this research had to fit certain criteria:

- First, the companies had to be Egyptian industrial construction companies that took a contracting role in their projects. In this research, the term ‘industrial’ refers to the type of heavy construction that is characterized by a production-related function. For example, cement projects are industrial in the sense that these projects are usually characterized as heavy construction and eventually lead to the production of cement. The reason behind the criterion of focusing on contracting companies is that problems concerning claims originate from the contractor’s side most of the time. Therefore, by studying contractor-based claims a deeper insight can be gained regarding claims problems in the industry. The reasoning behind using only Egyptian industrial companies and not foreign companies is that this research is limited to analyzing and eventually improving claims management of Egyptian companies operating in the industrial construction industry. Foreign companies operating in Egypt and under Egyptian law cannot be considered part of this research because they usually apply the management systems of the mother company with slight modifications in the host country (Pralhad and Lieberthal, 1998). Therefore, the claims management skills of

such companies would still not represent the Egyptian management skills, even if they are operating under Egyptian law and jurisdiction. Therefore, since this thesis aims to improve the Egyptian companies' manner in managing claims and change orders, only Egyptian companies were sought to obtain the sample projects.

- Second, the companies in this research had to have significant experience in industrial projects and should be characterized as middle to large sized. A company that fits the above-mentioned categories whose cumulative industrial work volume was below LE 50 million was not considered in this research, on the assumption that a LE 50 million work volume represents a significant contribution to the industrial sector. Middle to large sized companies were chosen on the assumption that LE 100 million worth of construction projects represents a middle-sized company in the field of construction. A summary of the research criteria is shown in table 2-1.

Table 2-1: Projects Size and Company Volume Selection Criteria

Selection Criteria	Ranking in Research
Company cumulative industrial work volume < LE 50 million	Small contribution to the industrial sector; not included in research
Company cumulative industrial work volume > LE 50 million	Significant contribution to the industrial sector; Included in research
Company cumulative construction work volume < LE 100million	Small size; Not included in research
Company cumulative construction work volume > LE 100 million	Middle to large size; Included in research

Borderline values of LE 50 million for industrial contribution and LE 100 million

for cumulative construction work volume in table 2-1 are not based on a certain reference and are not supported by documentation. However, it is after the revision of the cost of several industrial projects for companies that fit the criteria of this thesis that these values were obtained. It was clear that heavy industrial projects performed by experienced Egyptian construction contractors in the industrial sector fall within those ranges. Any company whose cumulative work volume is lesser than LE 100 million can be safely described as not middle to large sized. By the same token, a company with a cumulative industrial work volume lesser than LE 50 million can be described as not having enough experience in the industrial sector. The latter presumption can be verified by the work volumes of the companies used in this research. These companies have all been playing an active role in the Egyptian industrial sector for at least a decade. It is worthy to note also that the requirement of the companies to have had adequate experience in the industrial sector conforms to the trend noted in the literature review. One notable example is the research by Abel Razek (1998), which was based on the largest contracting company in the Middle East. Another example is the research conducted by Hanna and Russel (1998), which incorporated companies with work volumes ranging from USD 18.5 million to USD 123 million. This range is in harmony with that used in this research. There has been no documented research in the literature review that was based on a small-sized company or project.

- The basic justification for choosing companies of such high-level experience in industrial construction and not just any company whose work volume included a small-level industrial project is attributed to the unique environment in which claims of the former type develop. This environment is unique in the sense that it combines two

opposing characteristics. The first is the strict specifications and supervision requirements that are imposed on such projects and the second is the fast track characteristic of such projects that entail simultaneous progress of the design and construction phases in a project, thereby laying the grounds for significant claim propagation. This paradox is the key characteristic for imposing such requirements on the criteria of the sample projects' companies.

2.3.2.2 *Sample Size*

To arrive at an appropriate sample size for this research, a variety of statistical and research sampling sources were sought. The most appropriate sampling procedure that suited the nature of this research was that outlined by Joseph Maxwell called “*purposeful sampling*”, which was defined as follows :

This is a strategy in which particular settings, persons, or events are selected deliberately in order to provide important information that can't be gotten as well from other choices (Maxwell, 1996).

Since there is a limited number of Egyptian contracting companies with at least LE 100 million cumulative worth of construction projects, whose industrial portion exceeds LE 50 million, a large number of these companies were selected using purposeful sampling because information cannot be obtained otherwise. Therefore, the sample size will be the number of industrial projects that could be obtained from these companies.

As a means of validation of the samples obtained, the total work volume of the companies from which the sample projects were collected had to be compared to the actual total Egyptian heavy industrial work volume within the past decade. Once this

comparison was made, the degree of this research's representation of the heavy industrial contracting sector in Egypt could be clearly demonstrated. However, two main obstacles were encountered that could be highlighted in the following questions:

1. What is the means of obtaining a value that represents the cumulative work volume of the Egyptian contracting sector operating in heavy industrial construction?
2. It is only natural that the target companies would not grant access to the entire projects each company is involved in due to certain obvious and understandable reservations. Hence, in case a limited number of projects was made available to the researcher within those companies, how can the number of the sample projects obtained be evaluated as sufficient or not, in relation to the total industrial scope of the companies? In other words, the answer to the question “ Is the limited number of samples obtained representative of the companies' industrial work volume? ” is sought.

To tackle the first problem, the respondent was asked about his/her estimation of the total Egyptian contracting sector operating in the heavy industrial construction sector. Although the anticipated direct answer was that this is a difficult, almost impossible, value to estimate, it would be stressed that an approximate value is only sought. After arriving at several approximations from the various representatives of the companies, the average of the results is taken as the approximate value of the required parameter. The respondent is then asked about the industrial work volume of the company. The summation of this answer for all the companies included in this research represents the total industrial work volume that this research incorporates. The percentage of the industrial sector that this research addresses in relation to the total industrial sector

actually present in Egypt can then be obtained and the research sample validated.

At this point it is important to reiterate to the discussion made previously in section 2.3.1 that addressed the respondents' qualifications and requirements. A brief outline of the background of the respondents who gave the approximate figure to the researcher can be summarized in table 2-2.

Table 2-2: Outline of Respondents Experience

No.	Position	Experience (years)	Remarks
1	Projects Controller (Cement Division)	16	Holds a MSc in construction management & has been working in the industrial sector for more than 10 years.
2	General Manager	16	Owner of a middle-sized company for at least 10 years, and the company is gaining grounds in the industrial sector.
3	Projects Controller	20	Holds a MSc in construction design and has had some experience as a designer in the US. Respondent is heavily experienced in Egyptian industrial projects (at least 15 years of experience)
4	Contracts Manager	15	Some experience in Kuwait (substations construction). Considerable experience in a variety of industrial projects in Egypt.
5	Commercial Manager	10	Experienced in bidding of various industrial projects in Egypt.

It can be clearly concluded from table 2-2 that the respondents who managed to

furnish an estimate for the Egyptian industrial sector work volume are a reliable source for this type of information. Their notable experience in the industry and high positions in their respective companies indicates that these estimates are on firm basis.

The second obstacle can be overcome by using principles of statistics for standard error of the mean (σ_x). The standard error of the mean can be used to determine how close a sample mean might be to the mean of the population from which it came (Freund et al, 1993). In this research, the total number of projects available in the companies surveyed represents the finite population (N). The actual number of projects collected represents the sample size (n). Calculation of the standard error of the mean (σ_x) can be determined as shown in equation (2.1):

$$\sigma_x = \sigma / n \times \sqrt{N-n / N-1} \quad \text{Eq. (2.1)}$$

where σ = the standard deviation of the population

It can be noticed from this equation that as the sample size approaches N, σ_x approaches zero, meaning that the standard error of the mean decreases as the number of sample items increases.

It should be noted that the standard deviation of the population could be calculated from equation (2.2), as follows:

$$\sigma = \sqrt{\sum \sum (x-\mu)^2 / N} \quad \text{Eq. (2.2)}$$

where x = population set of numbers

μ = population mean

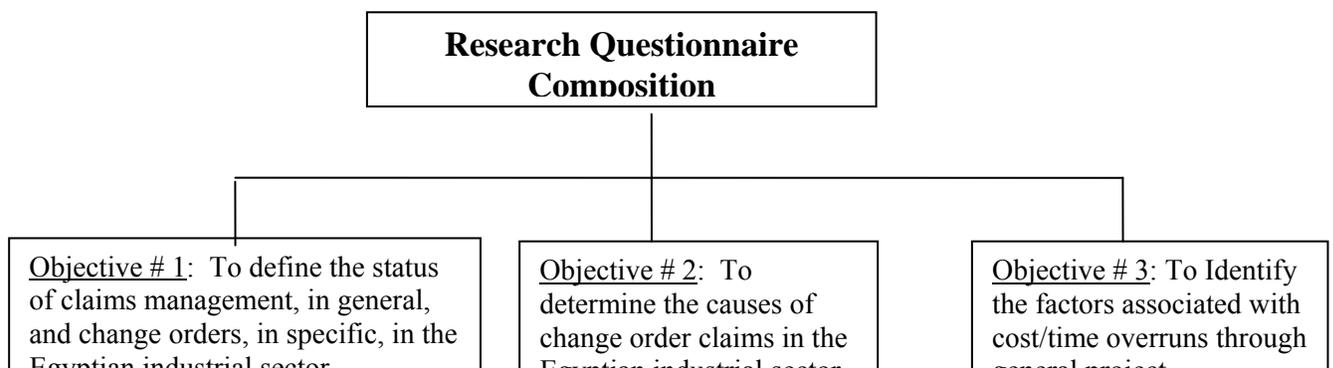
Therefore, the first step in calculating the standard error of the mean is the calculation of the standard deviation of the population. Then the standard deviation of the population and the population and sample sizes are then used to calculate the standard

error of the mean. At that point, a judgement must be made as to whether the answer obtained is close to zero or not. It can be shown from equation 2.1 that when the sample size equals 1 ($n = 1$), the standard error of the mean equals the standard deviation of the population, and when the sample number equals the population number ($n = N$) the standard error of the mean equals zero. Hence, the answer obtained from substituting in equation 2.1 would be compared to the range from zero to the standard deviation of the population. The closer the answer is to zero than to the standard deviation of the population, the more representative the sample is to the population from which it was obtained. Calculation details shall be demonstrated in section 3.2 of the next chapter.

σσσσσσ

2.3.3 Questionnaire Formulation

The process by which the questionnaire was formulated involved conducting extensive literature research on the most noted claims and change order areas discussed in reputable construction management journals, keeping in perspective the four main objectives of the research. Consequently, questions were grouped in three different sections, each section involving the objective that it aims to fulfill. The integration of the three objectives results with and the literature review would then form the grounds on which the fourth objective would be based. This section shall discuss in detail each question in light of the literature research on which it was based and the main objective that it aims to fulfill. The questionnaire questions are shown grouped according to the objective each aims to fulfill in figure 2-1.



Objective 1: To define the status of claims management, in general, and change order claims management, in specific, with respect to the Egyptian industrial construction sector

The strategy that was implemented to fulfill this objective was to begin with the significance of claims in general and then gradually understand the significance of change order claims. The basic idea behind this strategy came from some of the documented results of the literature survey conducted earlier, which had proved that change orders were the most dominating factor in all the various types of claims. The significance and weight of these claims is shown in questions # 1 and 2. After arriving at the significance of claims and change orders their status in the target projects will be sought. This is implemented by asking questions regarding the target areas discussed in section 2.2, the “Research Objectives” section, beginning with claims in general and gradually converging onto change order claims in specific, so that the base for the second objective would be founded. This is shown in questions # 3 to 9, as shall be discussed in detail in the remainder of this section.

Question # 1 : The claims that occurred in this project can generally be attributed to :

- a) Change orders (design changes, extras ...)
- b) Faulty or late owner-supplied materials and equipment
- c) Inadequate bid information
- d) Poor quality of drawings and specifications
- e) Other

Question Rationale :

The causes of claims listed in the aforementioned question have been obtained

from the research conducted by Jergeas and Hartman (1994). The authors actually list additional factors, but the four in the question were chosen as these factors are among the most common in the Egyptian industrial sector. As discussed earlier, this question serves two purposes. First, it is an indication of the type of claims that are experienced in heavy industrial projects. Second, it paves the way to understand the weight and significance of change order claims, in specific.

Question # 2 : The percentage of change order claims relative to the total claims in the project is:

- | | | |
|-------|-------|---------|
| a) 5% | c)15% | e)50% |
| b)10% | d)20% | f)Other |

Question Rationale:

This question is simply a logical extension of question # 1, as it serves to highlight the significance of change order claims in relation to the other claim types in the project. This question is placed in anticipation that the answer would indicate that the majority of claims are, in fact, change order claims. Comprehensive research on claims by Diekmann and Nelson indicated that 72% of all contract claims originate from change orders (Jergeas and Hartman, 1994). Design errors accounted for nearly 46% of these change orders (Burati, 1992). Hence, this question was designed to build on Diekmann and Nelson's theory on this significant weight of change order claims.

Question # 3: In this project, what is the percentage of claims notices that were directly tied to a contract clause ?

a) 5%

c)15%

e)50%

b)10%

d)20%

f)Other

If the answer is (f) please specify.

Question Rationale:

The question aims at illustrating the status of claims management, and one of the most commonly discussed parameters of proper claims management is the qualification of claims, as discussed previously in the literature review. In an article written as a guideline for engineers entering into arbitration, the authors outlined the importance of proper contract administration and specifically addressed the issue of relating every dispute to the contract, stating “If the issue at point cannot be tied specifically to a contract clause, it will be difficult, if not impossible, to prove the merit of the claim” (Gransberg and Joplin, 2000). It is this important concept of contract management and specifically the speculation of the lack of that important aspect in the target sector of this research that stimulated the need for this question. The main target behind this question was to understand the status of contract management, but in an indirect way that would not alert the respondent or lead him to a specific answer.

Question # 4: What is the procedure through which the documentation for a claim is handled?

- 1 Do you believe that there were change orders to which you were entitled but which you did not obtain due to poor documentation?
- 2 In your opinion, what documentation may have helped improve your records management in this project?

Question Rationale:

It is without a doubt that one of the greatest weaknesses in the construction management arena in Egypt in general is that of proper records management. This area has not been given the attention it deserves not only in Egypt, but also elsewhere in the world. For example, in a research conducted in the UK concerning the reasons for the consultants' rejection of contractors' claims, one of the main causes is the poor information systems and documentation practices by contractors (Vidogah and Ndekugri., 1997). It is because of this common weakness that many research works were dedicated at finding solutions to this problem. One of the articles strongly called for the development of a records management program inside engineering firms, utilizing records management organizations and consultants, if necessary (Hamilton, 1991). It is after analyzing this article and the need to explore the status of this aspect of claims management that this question was triggered. The question is divided into two main parts. The main question aims to arrive at the cycle of a claim documentation process inside a project once a claim issue is initiated. The first part of the main question aims at identifying the losses experienced due to lack of proper documentation. Finally, the second part aims at noting the possible means of improvement in this area in the respondent's opinion after the project had been completed.

Question # 5: Does the contract in this project stipulate that all change orders must be written?

Question # 6: Were there any oral change orders in this project? If yes, how were they handled?

Questions Rationale:

The formulation of these two questions was made building on the article "Legal

Aspects of Oral Change Orders” (Thomas et al., 1991). Aside from the common defect in documentation procedures present in the Egyptian contracting industry in general, there is also that of frequent verbal instructions on the job site. This issue links to that of documentation in that frequent verbal instructions with no documentation to support these instructions leads to weak foundations in case of filing a claim. An interesting point that was brought up in that article is that, contrary to what the majority of people may think, oral change orders can be made valid if certain requirements are met. There have been certain rulings made by the US Court that were in favor of oral change orders, one of which was that made by the Supreme Court of Iowa, which stated that “oral change modifications can still be made valid even though there might be specific contract language prohibiting oral changes” (Thomas et al., 1991). The discussions presented in that article triggered the need to investigate the status of oral change orders in the Egyptian industrial sector. In order to gain a clear vision of this status, two areas were sought. The first was to understand the contract’s stance towards written versus oral change orders. The second was to explore the frequency of oral change orders occurrence and the means by which these instructions were handled.

It should be noted that these two questions and the two sections of the previous question constitute the transition in the trend of the questionnaire from the status of claims management in general to the status of change order claims management, in specific. Hence, these questions together with the forthcoming question aim to fulfill the second portion of the first objective, which is the determination of the status of change order claims management.

Question # 7: Is there an agreed-upon basis for quantifying changes that occurred in this

project?

Question Rationale:

Continuing along the track of exploring the status of change order claims management, one of the most noted topics of discussion is the means by which change orders are quantified. Two opposing forces are always in contact when it comes to change order quantification. The first is that of the owner and his representatives who believe that the contractor is always trying to ask for more money than he deserves and is trying to maximize his profits during the execution of changes by performing the least effort in exchange for the maximum compensation. The contractor, on the other hand, believes that the owner and his representatives will not fairly reimburse him for the costs of the work performed and the effect of the change disruptions on the harmony of the work progress. Several research works were aimed at obtaining a solution to this problem. The research performed by Fourie (1993) exemplified an interesting approach towards the solution of this problem. In his research, Fourie presents numerical formulae to calculate changes costs, and these formulae are to be agreed upon by both parties prior to the execution of the work. The changes costs are divided into several sections: method related costs, activity duration costs, project duration costs, quantity-related costs and change rate costs. It is this article that led to the inclusion of the aforementioned question in this research to determine if Fourie's logic is applied in any form in the Egyptian industrial sector, and hence, an understanding can be reached regarding the status of the problem of claim quantification. Although the anticipated answer is that there is no unified system for the quantification of change orders, this question also aims at exploring the possibility of the presence of such a system in the

future as a means of improving the management of change order claims.

Objective 2 : To determine the main causes of change order claims in Egyptian industrial construction projects

The answers to the questions presented so far shall present the status of claims management, in general, regarding the target sector of this research, namely the Egyptian industrial sector. In addition, a further understanding is necessary concerning the status of change order claims of this sector. Hence, the information obtained so far would serve to test the theory that change order claims are the most significant of all claim types in this sector and the type of problems experienced with such claims. The point that is left is the causes of these claims. This shall be demonstrated through the following three questions of this section.

Question # 1:

The main causes of change order claims in this project are:

- | | |
|---------------------------------|-------------------------------|
| a) Errors in contract documents | c) Unforeseen conditions |
| b) Additional scope of work | d) If others – please specify |

Question Rationale:

This question was based on two research studies. The first was conducted on nine fast-track industrial projects after the commencement of the construction stage in order to pinpoint areas of changes and deviations that caused the most quality problems (Burati., 1992). The result of that research was that the most troubling area of deviations was that of design, which accounted for a staggering 78% of the total number of deviations, whereas construction changes accounted for 16% of the total number of deviations. Hence, this question served to explore the possibility that the same trend might be

applicable to the Egyptian industrial construction sector. The dominance of the design changes factor over the others caused it to be the focus of the remaining questions of this section.

The research that affected the factors chosen in the multiple choice section was an article, the purpose of which was to outline a methodology through which the effects of change orders with regards to time and cost can be monitored (Veenendal, 1998). In the beginning of the article Veenendal presented the aforementioned factors as common causes of change orders. Hence, these factors were chosen in the question, in addition to other factors that can be identified by the respondent for the project in question.

Question # 2:

What is the percentage of change order claims attributable to poorly coordinated designs, plans and specifications?

Question # 3:

Can the relationship between the designer and contractor in this project be described as adversarial? If yes, what effect did that have on the change order claims in the project?

Questions Rationale:

In addition to the article by Burati (1992) that pinpointed the significance of design deviations on the quality of industrial projects, other research studies aimed at identifying the effect that design problems might have on the cost increase of a project. In his article “Cost and Quality Management”, Duttenhoeffer (1992) identified two important design factors that can escalate the costs of a project during the construction phase. The first is the presence of poorly coordinated designs, plans and specifications that can lead to conflicting information and, hence, to a dramatic increase in the number

of claims filed by the contractor. The second is the presence of an adversarial relationship between the designer and the contractor. It is in this situation that the design professionals take on a defensive position regarding items that they did or did not do during the design phase. When this is reached, the author states that “it is sure to spell *disaster*”(Duttenhoeffer, 1992). Therefore, it is the purpose of these two questions to test the validity of Duttenhoeffer’s theories regarding the Egyptian industrial construction sector.

Objective 3 : Identification of factors associated with cost/time overruns

As mentioned previously in section 2.2, in order to identify factors that are associated with cost/time overruns, increases in project time and cost need to be linked to the general project information to arrive at a general understanding of the most common elements causing the most turbulence. Once this is made and problems are identified, suggestions for improvements can be made using the information obtained from the literature research. The general project information sought is as follows:

- Project name
- Role of contractor (main or subcontractor)
- Contract conditions
- Contract type
- Ownership
- Estimated project cost
- Estimated project duration
- Actual project cost
- Actual project duration

Questions Rationale:

The logic behind this simple, yet very important, question in this research was influenced heavily by the research performed by Semple et al in their article “Construction Claims and Disputes: Causes and Cost/Time Overruns” (1994). The authors of this article used the general project information of 24 construction projects in Western Canada to generate one comprehensive table, from which several relationships were drawn. By doing so they succeeded in pinpointing the problematic areas that need to be improved. It is the author’s opinion that the inclusion of a similar, yet more comprehensive, table aimed at the Egyptian industrial sector would open doors to understanding the key elements that have caused the constant deterioration of claims management in the Egyptian industrial sector.

2.4 Conclusion

This chapter served to discuss the main logistics and strategies by which the research shall be carried out. In essence all research procedures follow the three objectives that this research aims at achieving, which can be summarized in identifying the status of claims, in general, then change order claims, in specific, and then arriving at strategies for improvement. The questionnaire used in this research was formulated based on extensive research conducted in Europe and North America and the supporting arguments for choosing each question were explained in detail. In addition, sampling criteria and methodologies were presented and justified. At this point, the results of the interviews conducted on the questionnaire contents and the associated analysis can be furnished. This is presented in the next chapter.

CHAPTER 3 : RESULTS AND ANALYSIS

3.1 Introduction

The purpose of this chapter is to discuss and analyze the answers made to the research questionnaires in order to fulfill the three research objectives. Each objective shall be addressed separately and the relevant results shall be presented and analyzed thoroughly. The detailed calculations and the data collected shall be presented forthwith in this chapter. It is important to note that the information presented in this chapter lay the foundation for the main conclusions that shall be drawn in the subsequent chapter of this research.

3.2 Sample Data and Validation

In section 2.3, sampling procedures were discussed thoroughly and two main obstacles to the justification of the research samples were given significant attention. The first was to prove that the companies under study in this research actually represent a significant portion of the gross Egyptian industrial work volume. The main obstacle to achieving that is the means by which a value for the Egyptian industrial work volume would be obtained. As mentioned previously, this would eventually be obtained as an average of all the approximate values given by the interviewed managers whom have all had significant experience in the industrial construction sector in Egypt and who are working in the companies from which the sample projects were obtained.

The data composition with respect to the companies from which the data was obtained is presented in figure 3-1. In figure 3-2, the sample companies are presented in terms of their industrial work volume in relation to the value obtained for the entire gross work volume for the Egyptian industry.

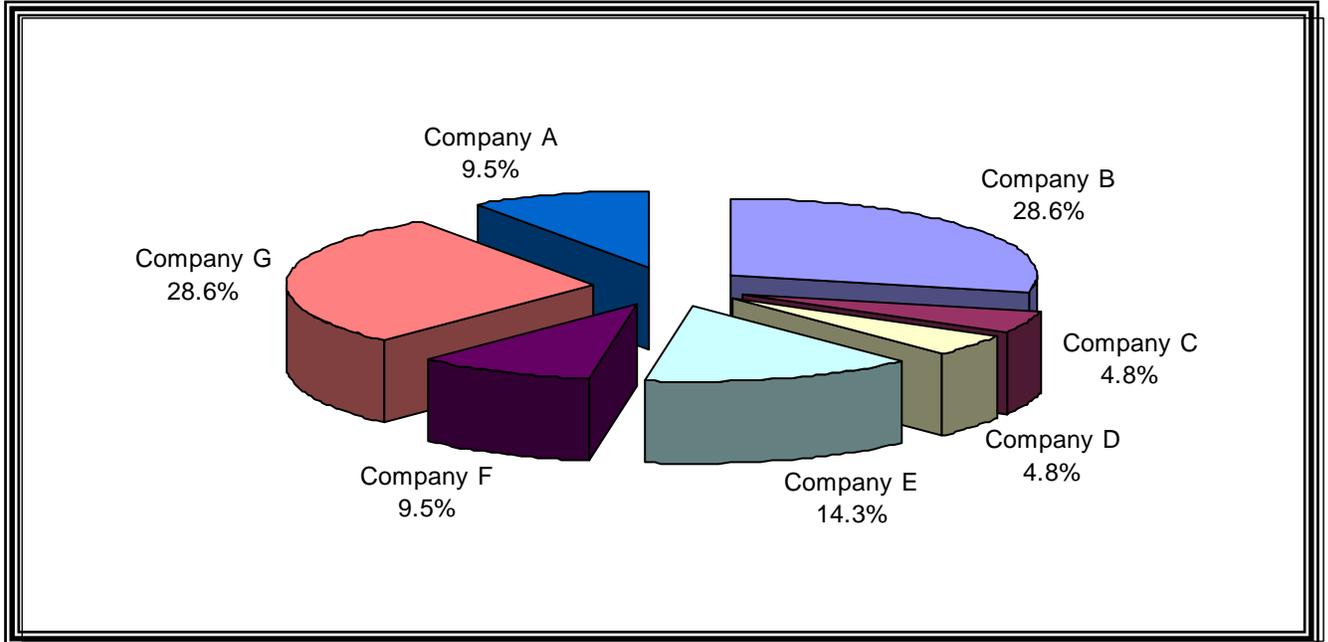


Fig. 3-1 : Data composition with regards to the companies involved

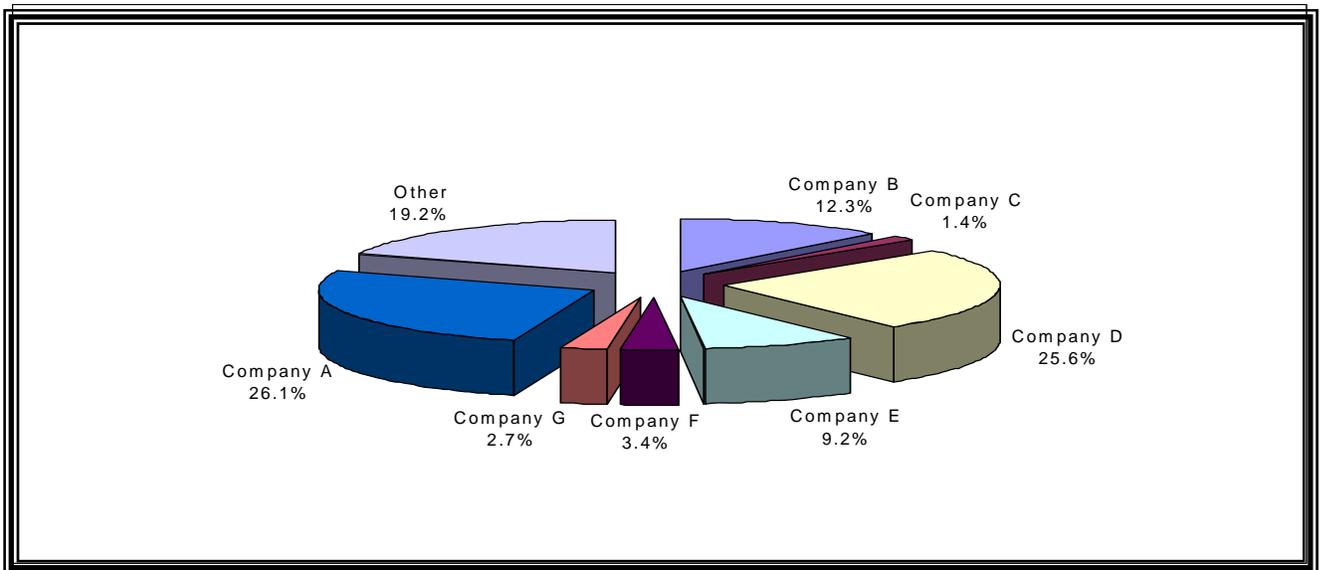


Fig. 3-2 : Companies Composition in terms of Total Work Volume of the Construction Industrial Sector

Figure 3-2 shows that the companies included in this research form 80.8% of the total Egyptian industrial work volume, which was estimated to be on the average a value of LE 3,904,000,000.00. The various percentages shown in figure 3-2 were obtained by dividing the industrial work volume of each company by that value. The result was that 19.2% only of the Egyptian construction sector operating in industrial projects are not discussed in this research. It is worthy to note at this point that there is no secondary data available that provides the size of the industrial construction work volume. As a result, an approximate value for the industrial work volume was obtained by taking an average of the estimates provided by the managers interviewed. Moreover, figure 3-2 demonstrates that the companies from which the research sample projects and industry estimates were obtained represent the majority of the Egyptian industrial construction sector.

The following step in sample validation is to prove that the actual projects collected for this research represent a sufficient value with respect to the companies' industrial work volume. Sampling calculations that utilize equations (2.1) and (2.2) are shown in Appendix B. These calculations show that the standard error of the mean for this sample and population data equals 0.392 and that the standard deviation of the population equals 2.07. As mentioned in section 2.3.2, the standard error of the mean is an indication of how close a sample mean is to the population mean from which it was came (Freund et al, 1993). It was stated also that the answer would be evaluated in accordance to a range starting from zero (sample size = population size) to the standard

deviation of the population (sample size = 1). Therefore, since the range of the data in this thesis ranges from zero to 2.07, and since 0.392 is closer to zero than to 2.07 in that range, this means that the amount of projects collected adequately represent the total number of projects available in the companies in the research. Since the companies in the research represent roughly 80.8% of the industrial work volume, the data presented in this research can be considered reasonably to represent the Egyptian industrial construction sector.

3.3 Objective # 1 : 1) Status of General Claims Management

As clearly demonstrated in the research questionnaire formulation section, the status of claims management is approached from a variety of angles, which include the types of claims prevailing, claims notification status and documentation procedures. The results of each of these areas shall be demonstrated and analyzed in the discussion that follows.

3.3.1 General Causes of Claims

The general causes of claims are demonstrated clearly in figure 3-3.

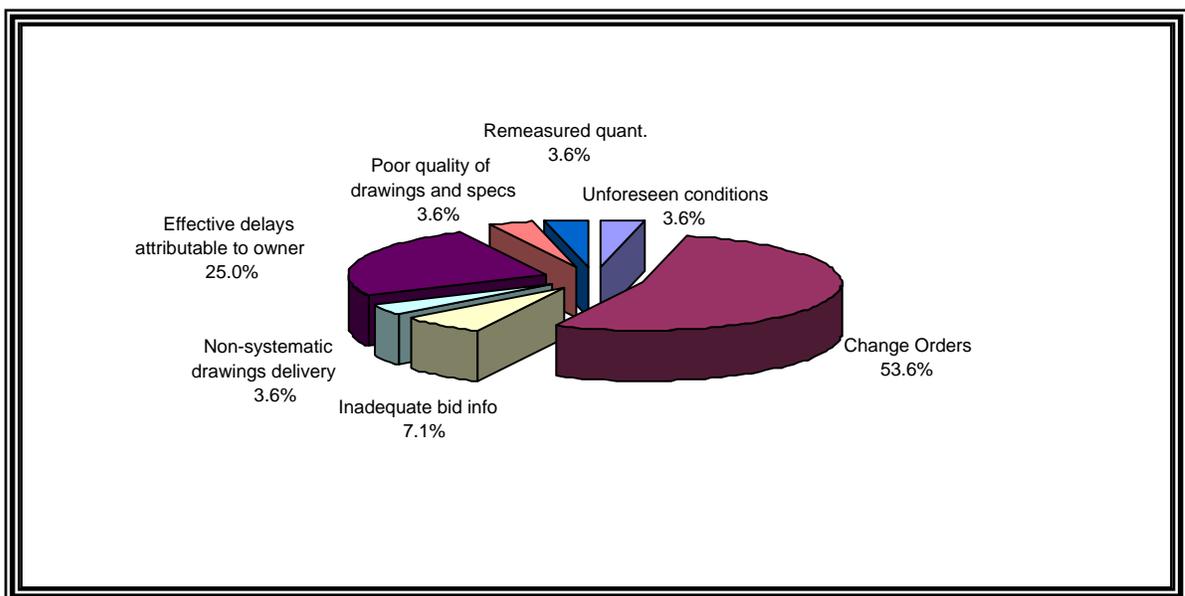


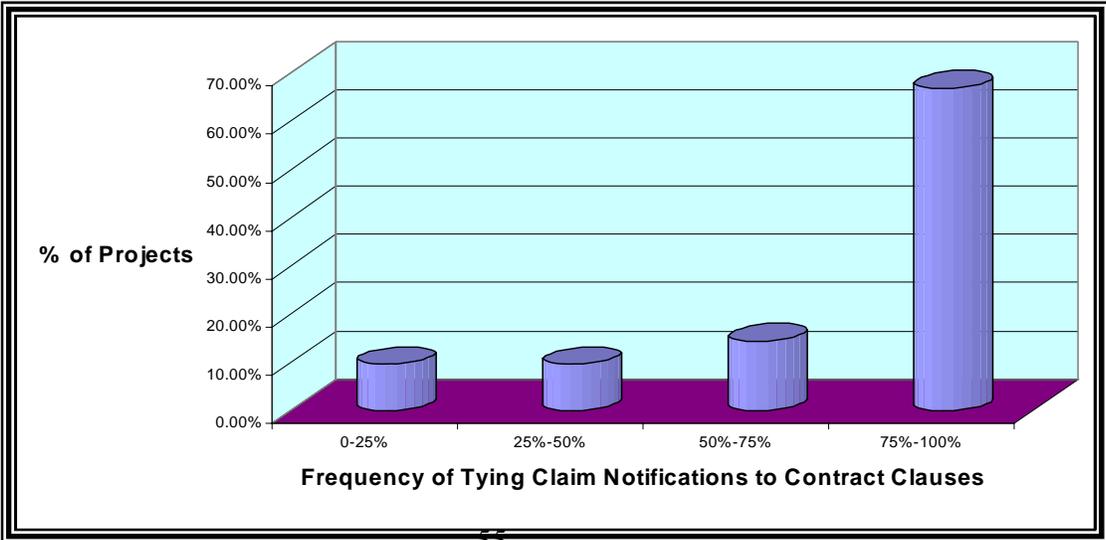
Figure 3-3 Causes of Claims in Egyptian Industrial Construction Sector

The results show that change order claims occupy the majority of claims in the industrial sector, as it represents 53.56% of the total number of claims. This result is in direct agreement with the research conducted by Diekmann and Nelson in 1985, which resulted in the conclusion that change order claims form the majority of claims in most projects (Burati, 1994). This result validates the necessity to further evaluate change order claims, in specific, in order to take a step forward for better claims management practices in the future. The second largest noted claims cause is attributed to delays caused by the owner. Responses by the managers interviewed divided these delays into three categories:

- Delays in the supply of materials and equipment
- Delays in payments
- Delays in providing construction drawings

3.3.2 Claims Notifications Status

The second parameter in the evaluation of the status of claims management is the qualification of change orders. Figure 3-4 demonstrates the respondents’ answers when asked how frequently notifications were directly tied to the relevant contract clause.



55
Figure 3-4 Claim Notifications Status

The results demonstrate that nearly 10% of the projects under study answered that notification made that were tied to a contract clause were made from 0 to 25% of the time. A variety of reasons were given for those figures. One of the respondents stated that notifications were never made in the first place because the contract that was made for that public project was very poorly formulated and did not incorporate any descriptions on claim procedures. In a different project, another respondent stated that only 30% of the notifications made were tied to a contract clause because the contract did not incorporate enough circumstances that the contractor would use of support of his claim. The owner of this project was also public. Both respondents stated that relations with the owner were jeopardized whenever notifications or documentation for contractual problems were made.

Another notable aspect in the results of figure 3-4 is that nearly 75% of the sample size answered notifications incorporating the relevant contract clauses are used the most of the time (from 50% to 100% of the time). The amount documented stating that the contractors surveyed always (100% of the time) refer to a contract clause in their notifications is actually 67%. It is worthy to note that these values are very high, which sheds some doubt as to the accuracy of these results. However, it is possible that the respondent feared undermining his company's stance by answering that contract clauses are seldom used in claim notifications.

3.3.3 General Claims Documentation Status

Although this question is sub-divided into two sections that deal with change

orders in specific, the main question concerning the procedure through which the documentation is handled in a claim refers to all types of claims and is not limited to change order claims only. The different procedures documented are listed and grouped in table 3-1 and a bar chart presentation is shown in figure 3-5, depicting the percentage of projects following the procedures of a certain group

Table 3-1 Claim Documentation Procedures

Group	Documentation Procedures	%
A	Site generates notification & office follows up contractually. Filed in one project file divided by separators. This procedure is especially followed when the project is small and does not have a management team of its own on site.	33.33%
B	Changes were collected then circulated and signed on site (sometimes signed in minutes).	4.76%
C	Using the program "expedition", claim cases and correspondences were grouped and filed according to the building in question to be used for future reference	4.76%
D	Site presents claim documents to head office, negotiations take place between site and head office, agreement made on course of action to be taken, head office takes decision, then site continues filing the claim.	4.76%
E	Documentation procedures are as dictates and specified in contract	4.76%
F	Site initiates claim through notification and variation order, then claim is taken to head office. Office analyses impact on time and cost, and claim is filed at office to be used at the end of the project	28.57%
G	Site handles claim completely and claim issues are filed among correspondences in various files.	19.1%
		100.00%

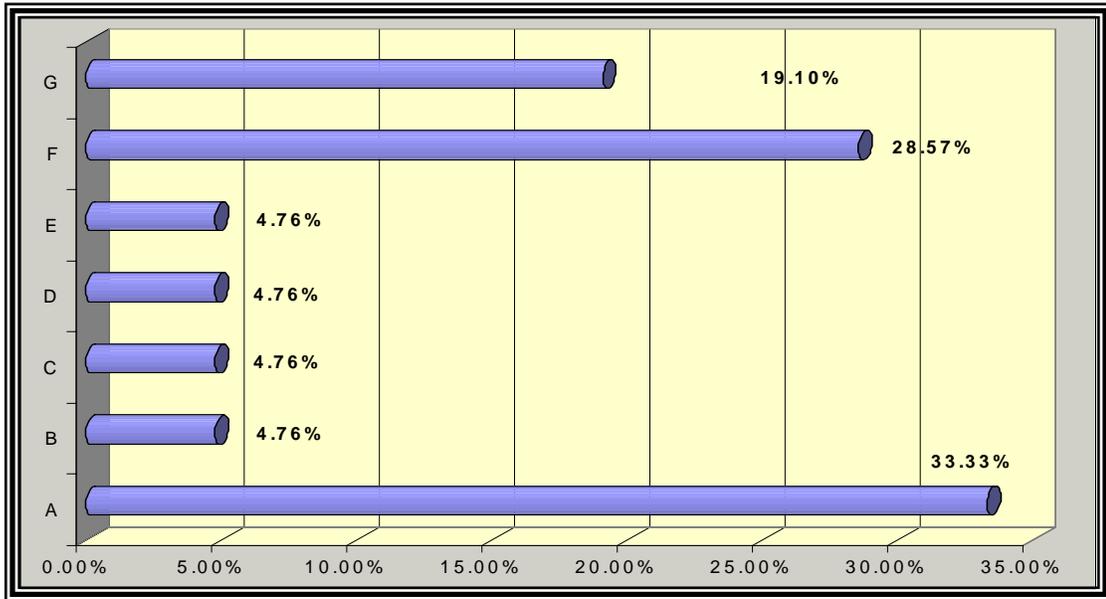


Figure 3-5 Claim Documentation Procedures

The results show that in most of the claim documentation procedures, work is divided between the office and site teams. As shown in table 3-1, the answers of the respondents are grouped according to similarities in responses. That is, responses that contained similar procedures were grouped together. There were eight groups, namely groups A to G. It should be noted that no distinct difference is apparent between groups A & F, that together form nearly 60% of the documentation procedures followed, which is essentially allocating the task of claim notifications to the site team. The site team, in turn, “hands over” all the contractual work to the head office team. The only difference between both teams is the timing of claim settlement. Group A settles each claim as it comes and continues monitoring its progress during the project execution, while group G compiles and files all claim issues until the end of the project. It is worthy to note that the procedure followed by group F is a form of claimsmanship, the “reservation of rights approach” (Zack, 1993) due to its characteristic of presenting all claims at the end of the project, and not as each one takes place.

It should also be noted that there are no special means of organizing and filing claim matters. Throughout most of the sample projects, claim matters were filed in one file, among the various other correspondences of the project. This is a vital point as it confirms the lack of proper documentation in the industry. The only exception is that of group C, in which the engineer handling the claims managed and tracked important claims issues through the use of the project management software “Expedition”, in addition to the hard copy for further claim support. When asked if there were any problems during the settlement of the claim, the engineer answered that the consultant could hardly turn down a claim issue because of the adequate and ready presentation of claims support that was provided.

3.4 Objective # 1 : 2) Status of Change Order Claims Management

After achieving the first portion of that objective, which is to arrive at the status of claims management in general in the Egyptian industrial construction sector, further attention is given to change order claims in specific. As shown, change order claims have proven to be the most dominating type of claims in this industrial sector and its status was evaluated through the interviews from various angles, such as adequate documentation, verbal instructions and claim quantification. In section 3.5, the second objective shall be presented through a more detailed insight on the main causes of change orders.

3.4.1 Change Order Documentation

The first question regarding that aspect of change order management was whether there were any change orders lost due to poor documentation. The responses obtained regarding that question are shown in figure 3-6.

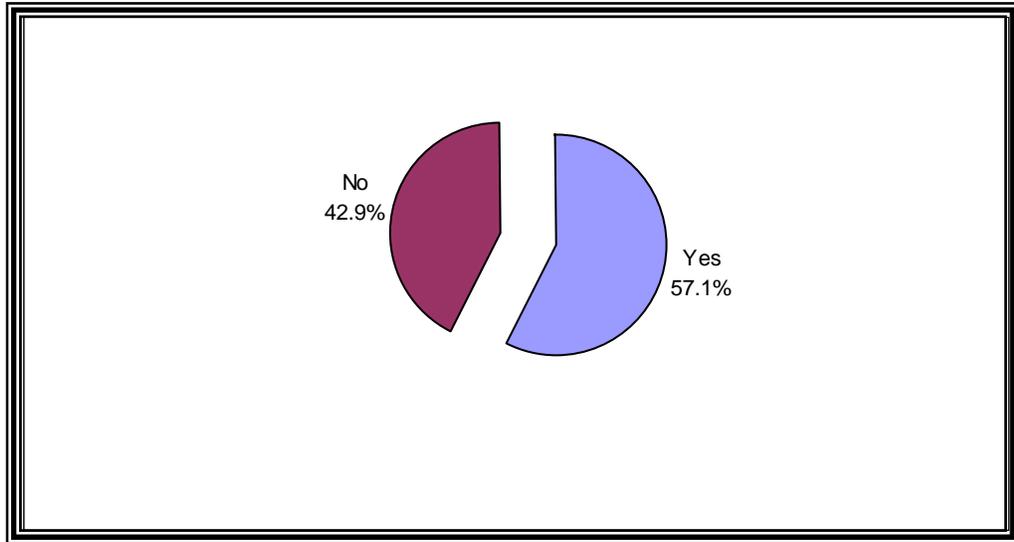


Figure 3-6: Any Change Orders Lost due to Poor Documentation?

The results indicate that the majority of the sample projects stated that change orders had been actually lost due to poor documentation practices. This result is in harmony with expectations made before conducting the interviews, as it is known that in Egypt, the problem of adequate documentation practices is significant and is indeed a barrier to proper claims management.

The second question that was made regarding documentation concerned the documents that the respondent believed would have significantly improved the records management in the project, and consequently claims management, had they been acquired. The results are shown in figure 3-7.

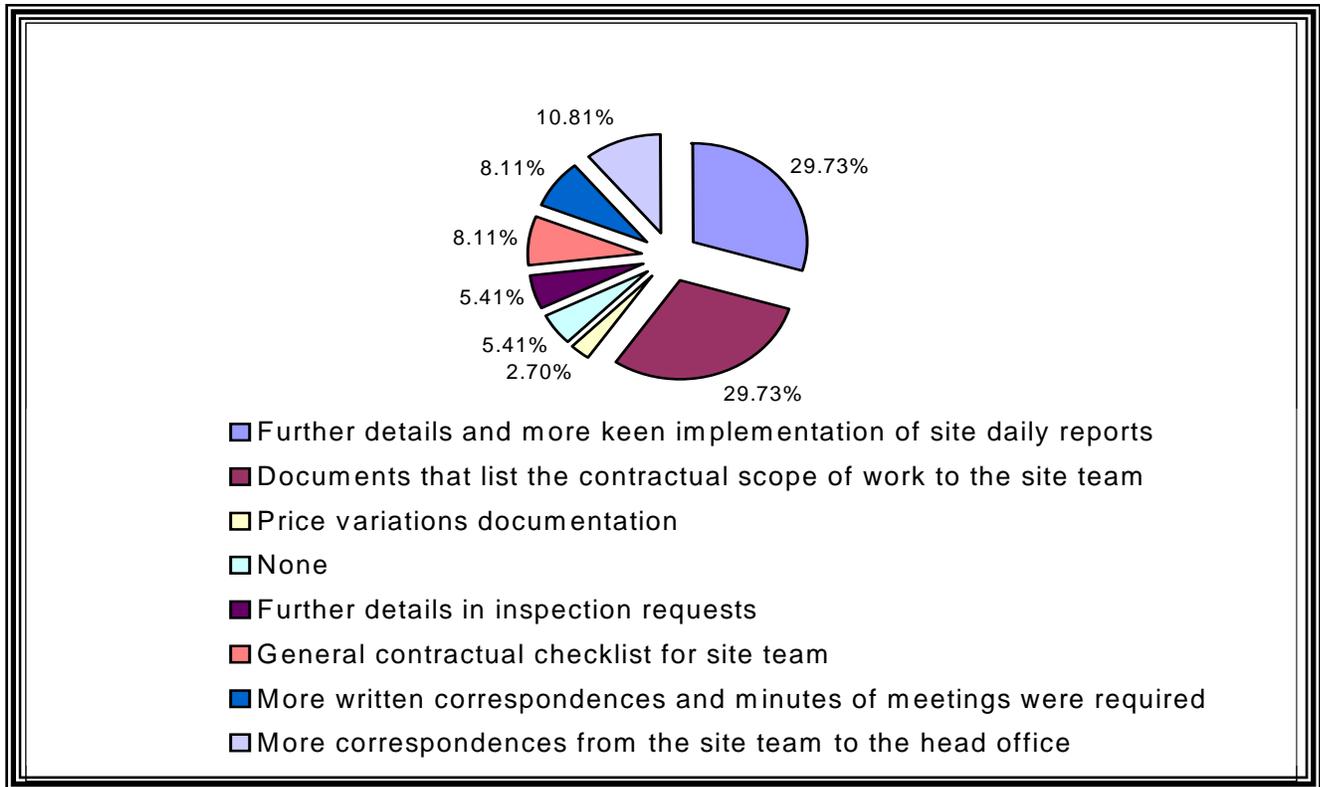


Figure 3-7 Documentation that may have Improved the Records Management of the Project

It is clear from the results presented above that one of the most important tools for proper documentation management is the use of daily records from the site team, especially if these documents are signed by the consultant. It was mentioned by more than one respondent that these records are the “diary” of the project and that they would have made all the difference if they had been properly filled out, or if they had been filled out in the first place. The absence of these records have been stated by many to have caused the head office team to lose contact with the events that happen on site and, therefore, have left the office team paralyzed in some claim situations that required support from daily events on site - such as equipment present, number of labors, quantities of concrete poured for a certain structure, and so on.

Equal in the importance of site daily records by the site team is the contractual

scope awareness of the site team. It has been mentioned numerous times in a variety of interviews that the site team in general lacks contractual awareness. One respondent clearly stated that it is not enough that the site managers would become contractually aware of their scope of work. Rather, the root of the problem lies in the site engineer who deals directly with the consultant. Numerous cases had been reported about site engineers who receive instructions from consultants and would not think twice about the contractual stance of these instructions. The result is significant loss of time and money. One respondent stated that one of the factors that would have improved the records management in his project would have been the replacement of the technical office engineer, who handled claims issues, by an engineer educated in claims management. During the course of one interview, it was suggested to the respondent that it might be helpful if a checklist that contained all the required contractual data would be made and sent to the site to be filled out with the daily report. Such a checklist would ensure that important contractual information would be obtained by the head office and that would force the site team to think contractual when facing problems on the job site. After that interview, a checklist was made and sent to the site.

It is interesting to note that while collecting the answers to this question, a phenomenon was observed in a significant portion of the results, namely that of the “fear of consultant”. In essence, the phenomenon means that contractors at many times would rather waive his contractual rights and suffer from losses than to risk losing relations with the consultant in times of conflict. Several respondents stated that this is a cultural factor, present only in the Egyptian industry and not elsewhere in projects conducted in Europe or North America. The explanation for this phenomenon is that it is a common

trait in the Egyptian culture to fear losing relations with the consultant or expatriate, even if financial and time burdens are the price. One respondent stated that there is a distinct difference between dealing with an Egyptian client and a foreign client in the sense that Egyptian clients are actually offended from contractual written notifications. One of the factors shown in figure 3-6, which involves more correspondences and minutes of meeting, is based on this phenomenon. The respondent stated that the manager of that project relented to a great number of claims issues because he feared to lose relations with the consultant, who was very upset whenever a notification or reservation of rights was made. On the other hand, despite the fact that relations may reach tensions at times with foreign consultants, there is confidence among Egyptian managers that no additional tensions may arise in cases of written claim notifications or discussions.

The documented cases that directly mentioned the “fear of consultant” phenomenon are shown in figure 3-8.

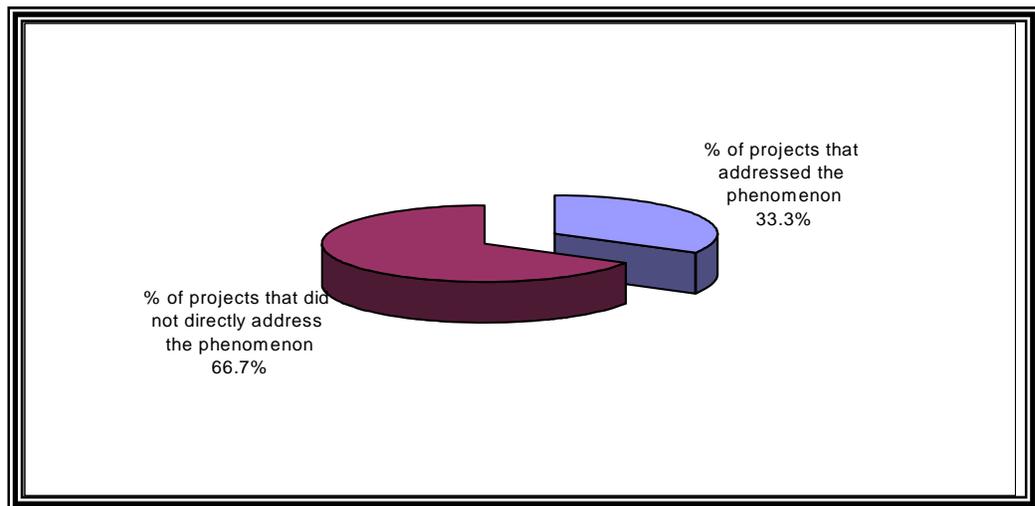


Figure 3-8 “Fear of Consultant” Phenomenon

3.4.2 Oral Change Orders

The status of change order claims management is then explored in terms of the management of verbal instructions. First, the respondents were asked if the contract used stipulated that all change orders must be written, then the question focuses on the frequency of verbal change orders and the means by which they were handled. Regarding the first point, in all projects change orders had to be written. This is an indication that rulings made in the US Court favoring oral change orders, as documented by Thomas (1991) in his article “Legal Aspects of Oral Change Orders” did not yet apply to contract formulation in Egypt. This is expected not only in the Egyptian industry, but also elsewhere in the world, as the prevailing attitude is that oral change orders have no contractual weight.

Regarding the aspect of the frequency of oral change orders and the means by which they were handled, the results are demonstrated in figure 3-9.

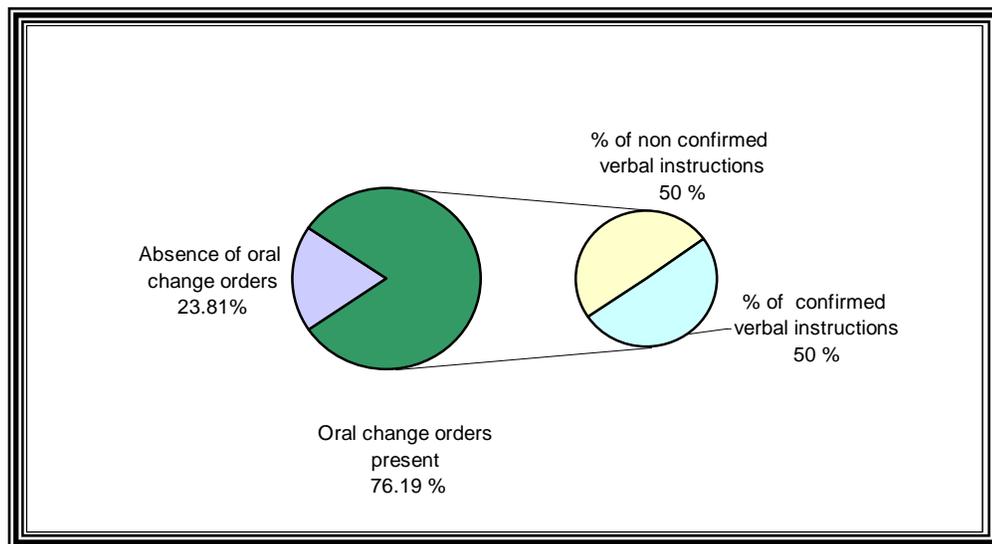


Figure 3-9: Documented Effects of Oral Change Orders

The results in figure 3-9 clearly demonstrate that oral change orders have been frequently present in nearly 76% of the project samples. Half of these oral change orders resulted in the loss of rights due to improper documentation practices. Respondents linked the improper documentation practices to lack of contract scope awareness and to the “fear of consultant” phenomenon. As mentioned earlier, the core of the problem rests at the site engineer, who receives almost daily site instructions from the consultant and does not hesitate to execute these instructions without referring to the contract. Another significant portion of the problem deals with the site engineers’ lack of awareness in other engineering activities. For instance, it was mentioned by one of the respondents that a significant amount of claim reservations were not made and extra works implemented due to the fact that these instructions, which encompassed electro-mechanical works, had been given to the civil engineer on site. The civil engineer, not knowing whether the allocated work is in the scope or not, consented immediately with no hesitations and with little reference to more knowledgeable engineers in the relevant field. This phenomenon has caused that company to hire experienced electrical engineers knowledgeable in contract management as a means to overcoming this problem.

3.4.3 Change Order Quantification

The next issue that was addressed with regards to change order claims management was that of the quantification of change orders. As discussed earlier, the purpose was to test the presence of Fourie’s logic in the Egyptian industrial sector, which is saturated with all forms of claims. The responses obtained were all indicative that

there are no such means of quantification for change order claims. It is the author's opinion that this is a gap that must be covered. Fourie's systematic presentation of equations by which costs for claims are calculated would reduce significant tensions between the contractors and consultants and would facilitate the claims evaluation process.

3.5 Objective # 2 : Causes of Change Order Claims

After discussing the status of both general and change order claims management, and after realizing the significant weight that change order claims carry, it is important to analyze change order claims further. In this section, the various causes of change order claims are presented and the effect of design modifications on change order claims is addressed.

3.5.1 General Causes of Change Order Claims

The results obtained from asking the respondents the causes of change order claims are shown in figure 3-10.

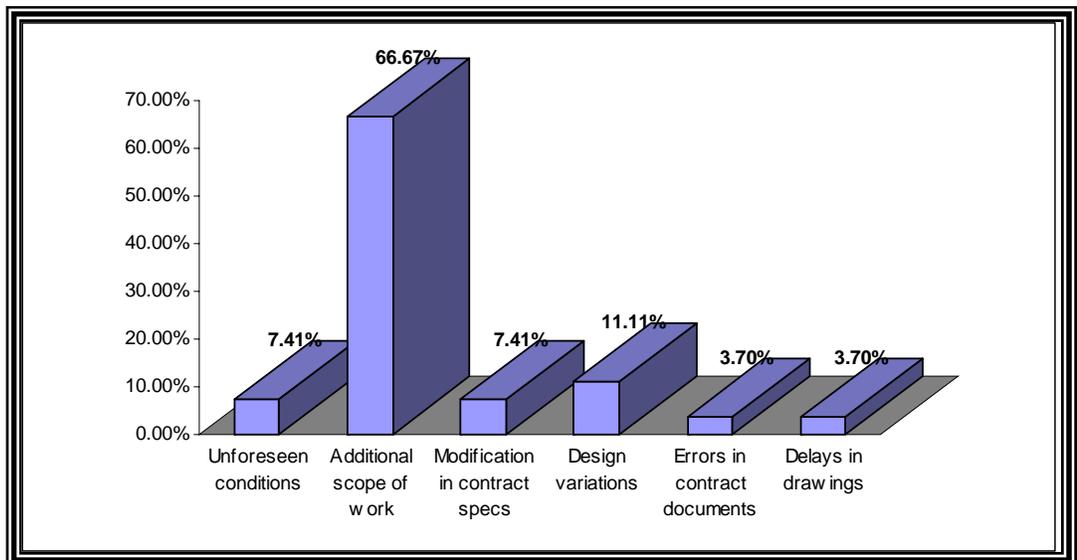


Figure 3-10 Causes of Change Order Claims

Figure 3-10 clearly indicates that additional scope of work is the predominant factor for change order claims. An adequate justification was made by one of the respondents discussing a project that encompassed the construction of a large cement plant. He stated that as soon as the process line buildings design is completed for the cement plant, the owner immediately tenders the project. Time is strictly of the essence as the owner wants to complete the project as soon as possible. Hence, construction and design phases would proceed simultaneously. All other work items that may arise during work execution that were forgotten during the design stage would be given to the contractor as extra work. It was the respondent's theory that early completion of the cement plant works would more than compensate the owner of any magnitudes of claims that may arise during the project execution.

3.5.2 Change Orders due to Poorly Coordinated Designs

As mentioned earlier, the following questions regarding the effect of design deficiencies were included in this research to test Duttenhoeffer's theories in the article "Cost and Quality Management" (1992) concerning the effect of poorly coordinated designs and relations with the designer on change order claims. The frequency by which poorly coordinated designs were noted in the sample projects is clearly demonstrated in figure 3-11.

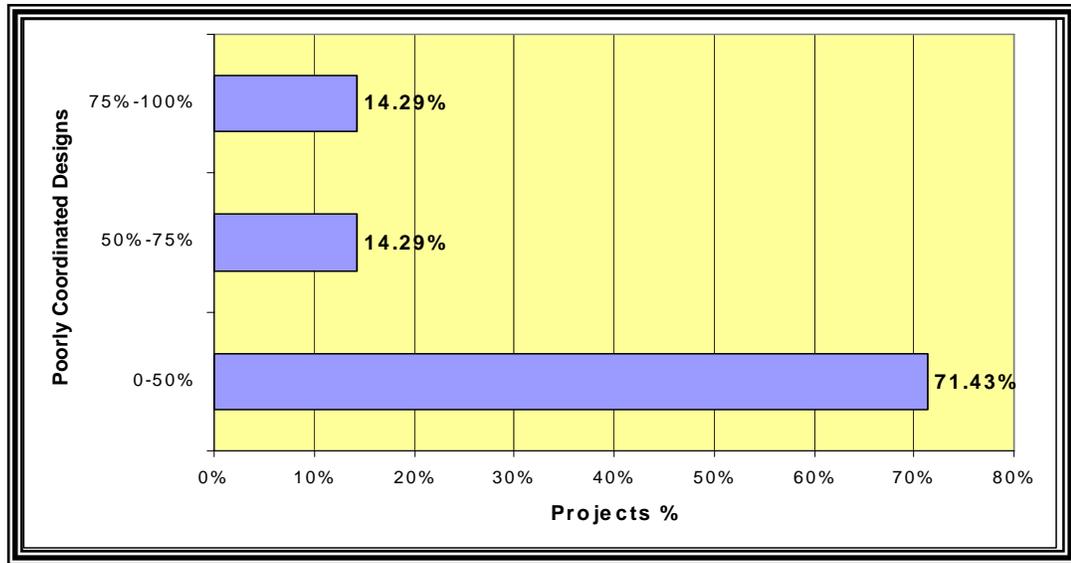


Figure 3-11 Change Orders Attributable to Poorly Coordinated Designs

Results in figure 3-11 show that 71% of the projects sampled contained poorly coordinated designs in the range of 0 to 50%. This figure is an indication that this type of problem is not a predominant factor, as Duttenhoeffer had anticipated. The reason can be attributable to the overshadowing of additional work on all other change order factors. Hence, although the industrial sector suffers from significant cost escalations due to deficient designs caused by the simultaneous progress of the design and the construction phases, the effect of additional work overshadows these effects as it has the main effect on cost escalations within the project.

As mentioned, Duttenhoeffer also stated that a disaster is sure to occur whenever there is an adversarial relationship between the designer and the contractor. This theory is tested and the results are as shown in figure 3-12.

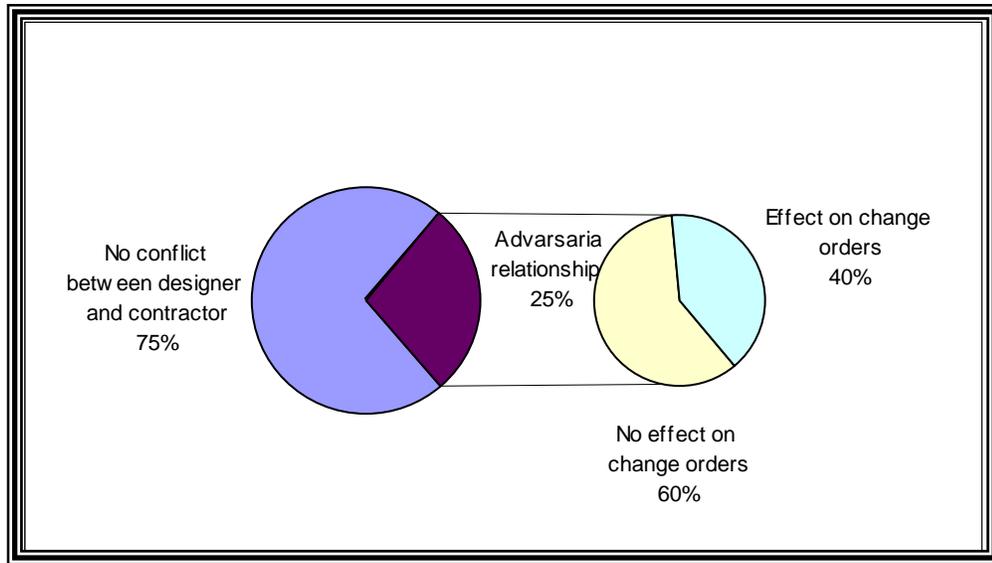


Figure 3-12 Effect of Relations with Designer on Claim Propagation

An adversarial relationship is documented to exist in 25% of the projects. However, contrary to Duttenhoeffer's theory, the adversarial relations that existed did not necessarily cause rapid claim propagation. In some cases, the adversarial relationship caused the designer to accumulate defects and arguments against the contractor and presented these arguments to the owner. The end result was that no effect was noted due to the settling of the matter between the contractor and owner in a conclusive meeting between them. In another case, the designer attacked the contractor in various meetings in front of the owner, but the contractor had enough documentation support to counter attack the designer, thereby resulting in a neutralizing effect on change order claims propagation. These situations are the result of interactions with Egyptian designers. It was a respondent's opinion that Egyptian consultants act aggressively with the contractor in case of an adversarial relationship. He attributed that to the fact of the designers not wanting to admit mistakes and to take on a defensive position every time a claim attributable to a design mistake is levied. This attitude eventually leads to the

bruising of relations between the designer and contractor, and even reduces the contractor's chances for future projects dealings. In agreement with that argument was another respondent who stated that a significant difference is noted when dealing with foreign designers than with Egyptian designers. He stated that foreign designers, in the presence of an adversarial relationship, do not take a defensive role every time a claim is levied, but rather, they argue within the documents and facts present.

3.6 Objective # 3 : Identification of Cost/Time Overruns

As mentioned earlier, the identification of the factors that are associated with cost and time overruns in a project shall be linked to the general project information. Therefore, this section will constitute an analysis of the general project information. First, the composition of the projects data shall be furnished. Then, an analysis of the project information will be performed to arrive at the factors associated with the cost and time increases. It is important to note that to gain a better understanding of this section, the information presented herein should be read in conjunction with the comprehensive tabulated presentation of the general project information in Appendix B. Furthermore, the calculation of the graphs illustrating the relation of each factor to the cost and time of the project (figures 3-17 to 3-24) are all furnished in Appendix B.

3.6.1 Data Composition

The information obtained from the general information section can be summarized in terms of the data composition as shown in figures 3-13 to 3-18.

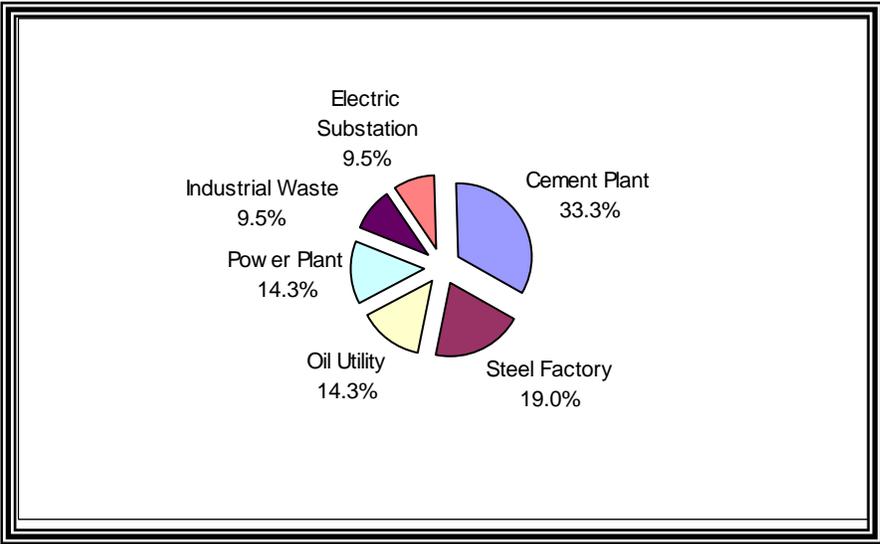


Figure 3-13 Industrial Type Composition

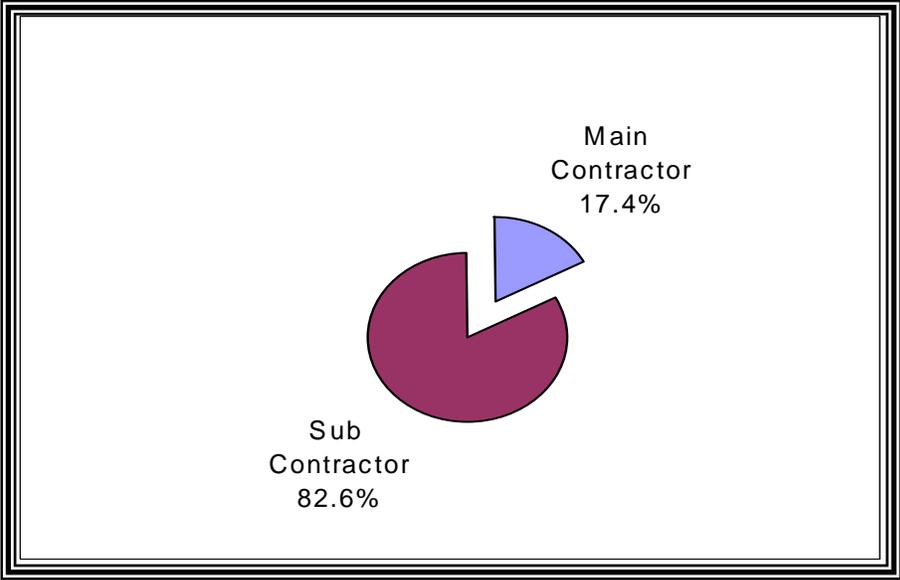


Figure 3-14 Contracting Role Composition

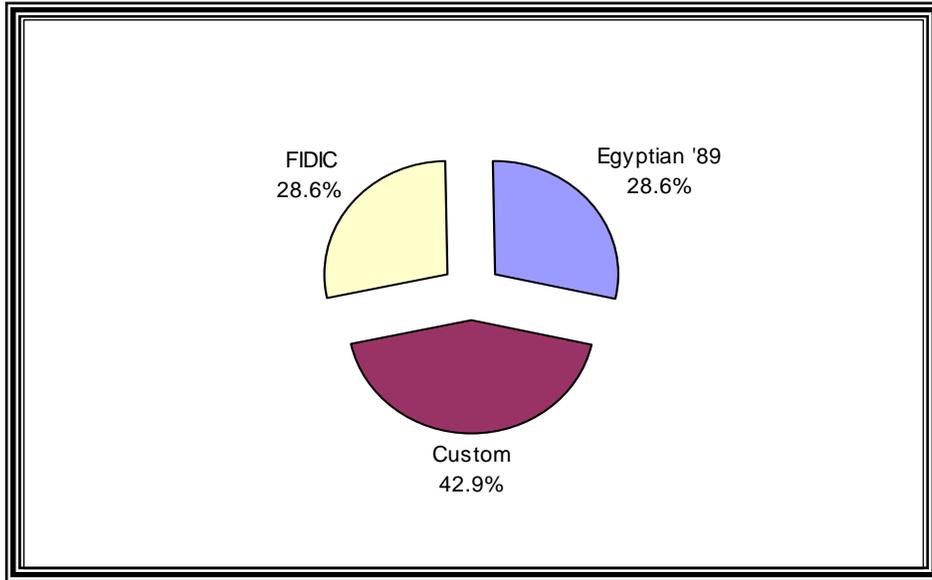


Figure 3-15 Contract Conditions Composition

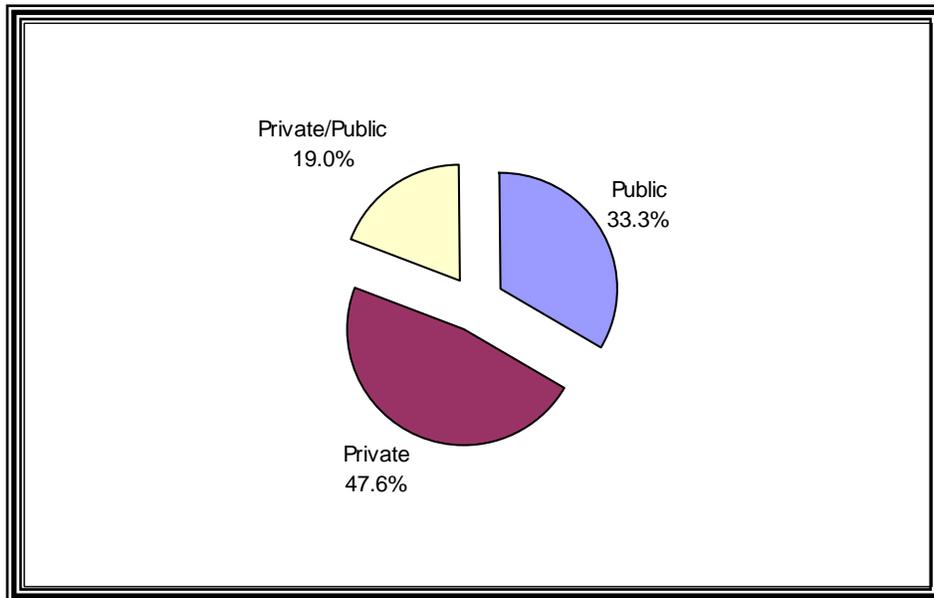


Figure 3-17 Ownership Composition
 Figure 3-16 Ownership Composition

3.6.2 Identification of Problem Areas

After demonstrating the data composition, the effect of each of the data parameters on the cost and time increase of the projects shall be furnished to arrive at the most influential factors on time and cost. It should be noted that figure 3-13 indicates that nearly 77% of the sample projects could be characterized as fast track within the industrial sector.

3.6.2.1 Cost and Time Increases for Various Industrial Projects Types

The association of industrial type with cost increase of the sample projects can be shown in figure 3-17.

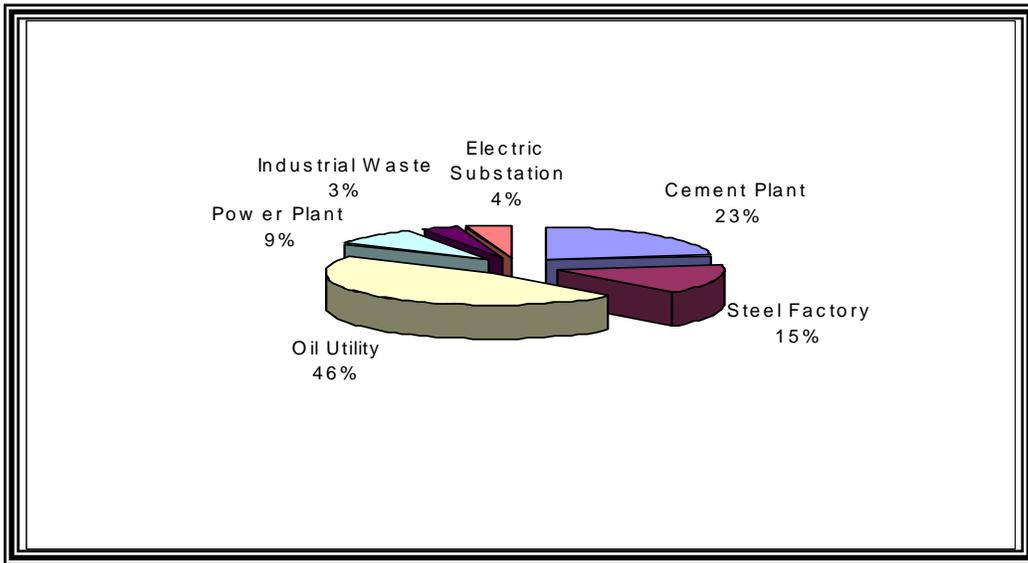


Figure 3-17 Industry Type and Project Cost Increase

It can be clearly shown from the figure above that project cost increase is mostly associated with oil utilities projects, as it caused an average increase of 46 %. However, this conclusion can be misleading as more oil utilities projects should be present in the sample projects to form such a conclusion. The second largest cost increase is associated with cement plant construction. The justification behind the cement plants experiencing a significant increase in cost can be attributed to the amount of additional work change orders given to the contractor as a result of the design not being completed prior to the tendering stage, as discussed earlier.

The same analysis can be made for the time increase effect, as shown in figure 3-18.

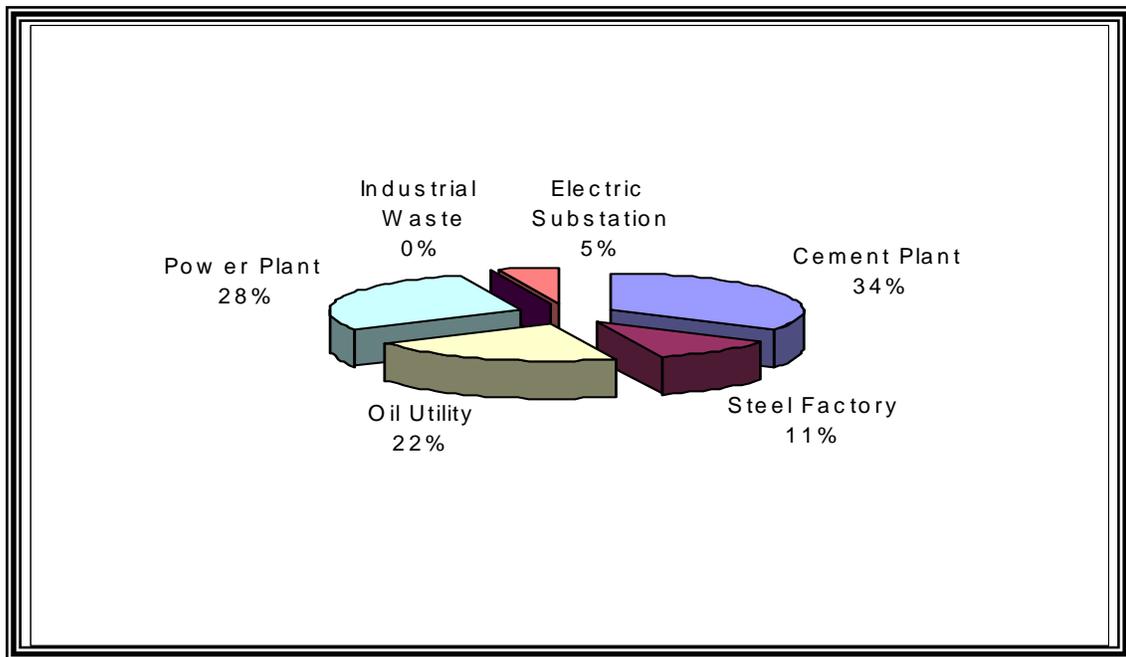


Figure 3-18 Industrial Type and Project Duration Increase

As anticipated, oil utility and cement plant industrial projects were among the highest increase in project duration. Also influential in this aspect are the power plant industrial projects as they ranked second after the cement plant construction in terms of their association with project time completion. This can be attributed to the effect of the

additional work volume on the initial planned work progress. It is worthy to comment at this point at the industrial waste projects value of no increase. It was mentioned by the respondents involved in these type of projects that the deadlines for these projects were not liable to any change, no matter what type of claims the contractor might experience. The contracts made for these types of projects were very stringent and did not contain adequate allowances for the contractor.

3.6.2.2 Cost and Time Increases for Various Contract Conditions

The association of contract conditions with the cost increase of the projects is shown in Figure 3-19:

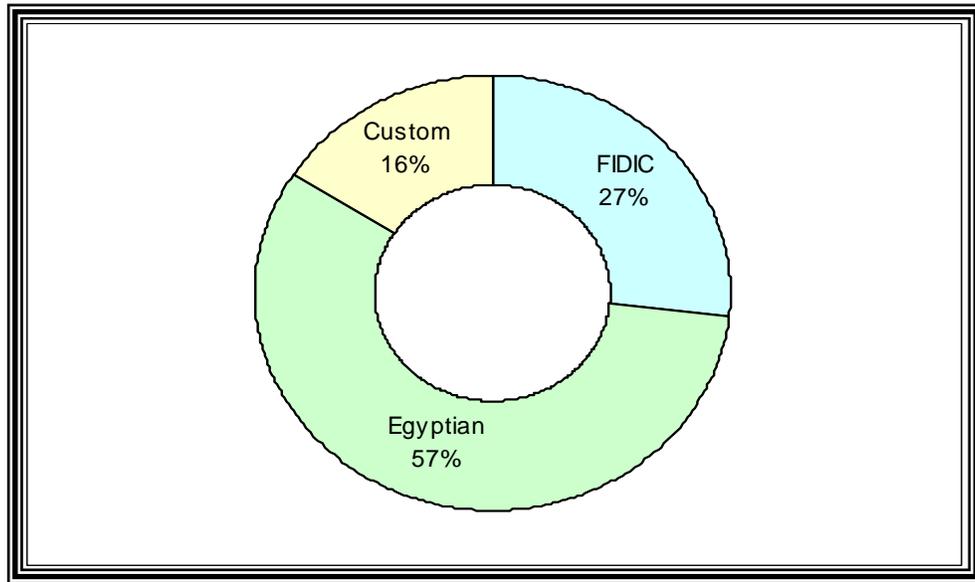


Figure 3-19 Contract Conditions and Project Cost Increase

As shown in figure 3-19, projects whose contracts incorporated the Egyptian Law of 1989 in the General Conditions section experienced on average a dramatic increase in

project cost of nearly 57%. This increase can be attributed to the selection of the lowest-cost bidder to -

The relation of contract conditions to project duration increase is furnished in figure 3-20.

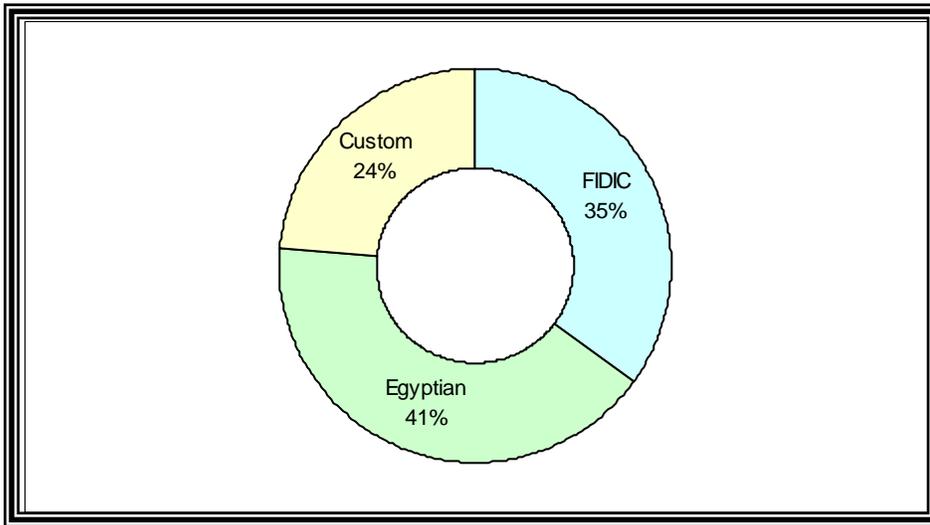


Figure 3-20 Contract Conditions and Project Duration Increase

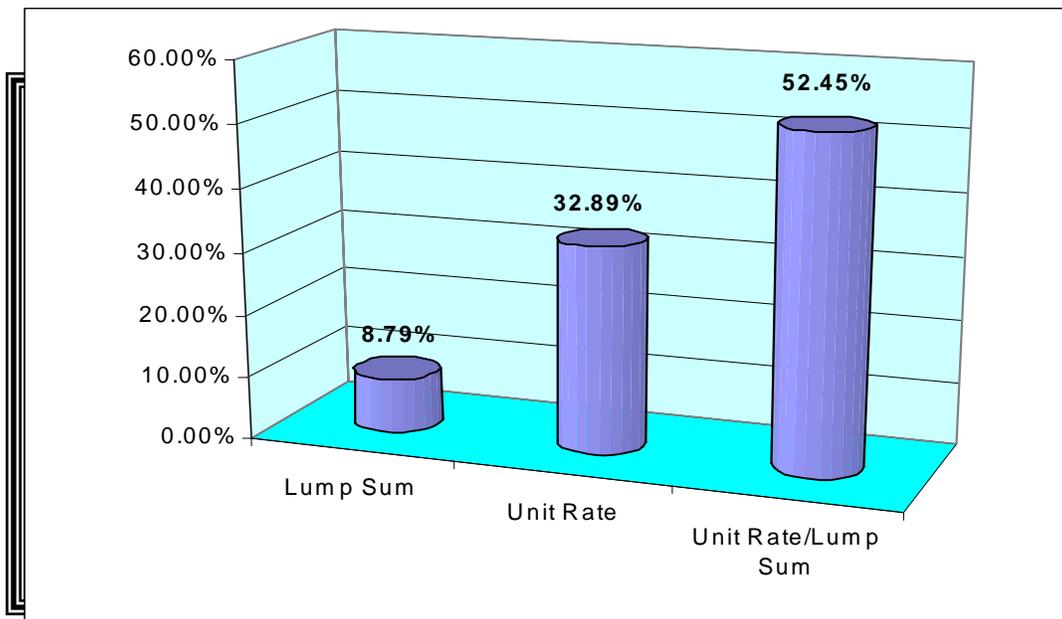
The results shown in figure 3-20 are compatible with those in figure 3-19, and the key problem area with regards to contract conditions is Egyptian Law 1989. A closer examination needs to be made regarding awarding the lowest cost bidder instead of the bidder with the best value (even if it is not the lowest cost), as this can cause potential problems with regards to time and cost.

It is worthy to note, though, that it has been mentioned during the past few interviews that the common trend in the present state is the formulation of custom-made general conditions that offer less flexibility in terms of cost or project duration escalations. As one respondent puts it, it is “not permissible” for a project to not end in its scheduled time for completion, and no allowances are to be made with regards to cost

compensations. Although the risks are high, contractors are forced to agree on such stringent terms for the sake of being awarded the works and risking that the inevitable may not happen. This trend can be proven by comparing the data composition chart of the contract conditions (figure 3-15) to the charts showing the effects on time and cost (figures 3-19 & 3-20). Although custom general conditions formulate nearly 43% of the sample data, they have the least effect on project cost and time escalations. However, this does not mean that these types of contracts are not potential problem areas in change order claims management.

3.6.2.3 Cost and Time Increases for Various Contract Types

Contract type is the next parameter for evaluation, as it is the tool by which measurement of the work progress takes place. The results of the analysis resulted in the



Following 21 Contract types are used, as shown in figures 3-21 and 3-22.

Both figures 3-21 and 3-22 show that unit rate have a strong association with the cost and time increases of projects. This can be attributed to the flexibility present in unit rate contracts for measuring extra works as they occur in a project. However, with lump sum contracts the release of extra payment cannot be made without obtaining various approvals and going through numerous lengthy negotiations with the consultant and the owner. The only exception to this assumption is when more flexibility is given to lump sum contracts, as in lump sum + unit rate contracts. As shown in figure 3-22, the latter type of contracts caused the largest effect on project duration increase.

3.6.2.4 Cost and Time Increases for Different Project Ownership

The effect of ownership on cost and time increases is demonstrated clearly in figures 3-23 and 3-24, respectively.

Figure 3-24 Effect of Ownership on Cost Increase

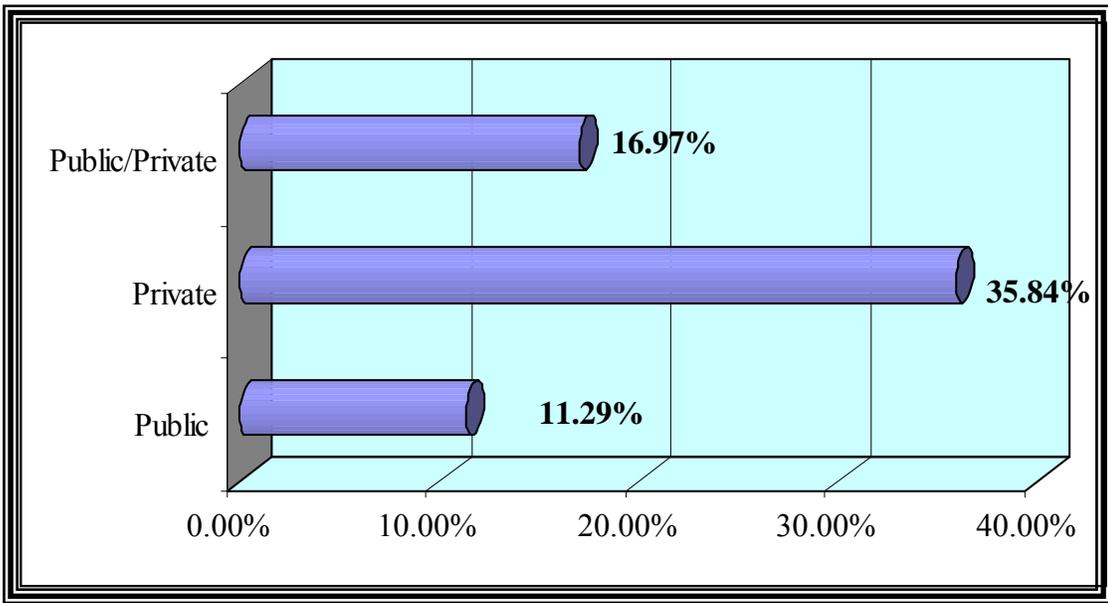


Figure 3-23 Ownership and Project Cost Increase

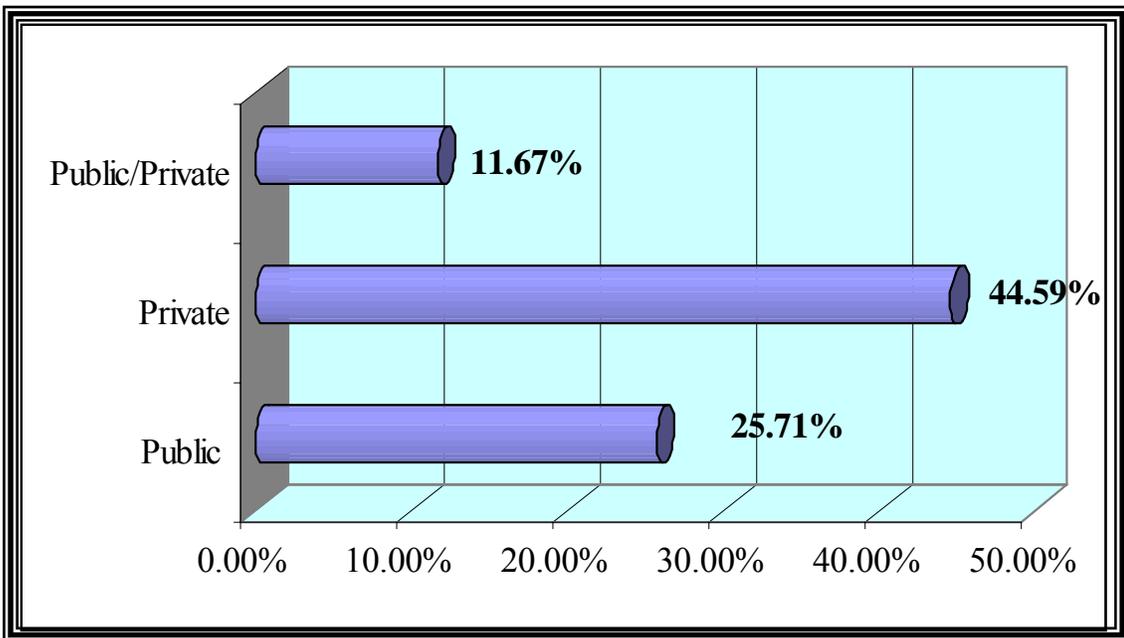


Figure 3-24 Ownership and Project Duration Increase

Figures 3-23 and 3-24 both indicate that projects with private ownership experience the most notable project cost and duration increases. This result is in direct agreement with the research conducted by Semple et al (1994). During one of the interviews conducted with the managing director of one of the sample companies, it was stated that privately-owned projects experience the most notable change orders due to the owner's free will or change of mind of some matter during work execution. The result is simply the execution of the owner's instructions in exchange for a change order claim to the contractor. In public projects, he continued, the issue is different. Although publicly owned projects are usually on the downturn as far as documentation and notifications are concerned (when made by the contractor), such projects experience less flexibility in project cost and duration variations.

3.7 Conclusion

This chapter can be described as the heart of the research as it encompasses the results and analyses that fulfill two of the main thesis objectives and pave the way to fulfilling the final objective. In this chapter, each objective was addressed and carefully analyzed. Several facts were documented regarding the status of claims management in this sector. For example, it was proven that change orders are the most common cause of claims in the Egyptian industrial construction sector. Moreover, several weaknesses were documented with regards to the management of claims, such as deficiencies in public contracts resulting in claim notification problems. Also observed is the type of documentation problems encountered in the industry. For instance, the main method of

documentation control are through one file per project that contains all project data, claims being one of its sections. In addition, the documentation procedures involve initiation of claim matter from the site team then follow-up from the office.

Due to their significant weight in claims causation, change order claims were the next focus of the research. It was documented by 57% of the sample projects in this research that change order claims had been lost due to poor documentation. Keen documentation of daily site records and contractual awareness of the site team were the two most documented means of improving change orders claims. Oral change orders played an important role in claims management as it was reported that 76% of the projects researched experienced oral change orders. Approximately 50% of sample projects experiencing oral change orders lost change orders due to the lack of proper documentation practices from the site team and due to the contractor's fear of bruising relations with the consultant, a phenomenon addressed by this research as 'fear from the consultant'. It was also documented that there is no unified quantification system for change orders, such as a unified set of formulae used to categorize change order costs (such as those used by Fourie (1993)).

The results then shift to the second objective, which is the determination of the causes of change order claims. Nearly 67% of the projects in this research stated that additional work was the predominant change order cause. This was attributed to the fast track nature of the industrial sector. Poorly coordinated designs did not prove to be a dominant cause of change order claims, as anticipated prior to conducting this research. Also contrary to anticipations, poor relations with the designer did not result in serious cost escalations.

Finally, the last segment of this chapter focuses on achieving the third objective, which is the identification of factors associated with project cost and time increases. Problematic areas that resulted from significant cost and time project increases as documented by the general project information results included cement plant and oil utilities construction, unit rate contracts, Egyptian law '89 general conditions and private owned projects. The subsequent chapter will utilize the important information presented in this chapter in order to fulfill the fourth and final objective of this research, which is the generation of means for improvement.

CHAPTER 4 : MEANS OF IMPROVEMENT

4.1 Introduction

The purpose of this chapter is to integrate the results obtained from the research questionnaires combined with research from the academic literature to generate a strategy for the improvement of claims management practices in the Egyptian industrial construction sector. This chapter shall serve the third and last objective of this research, which is to improve the status of general and change order claims management in the industry. In order to achieve that objective, first the problem areas addressed in the previous chapter shall be summarized herein. Then the problems shall be tackled and an improvement strategy shall be generated based on the nature of the problems and the documented solutions for improvement.

4.2 Documented Problem Areas Summary

In the previous chapter several problem areas were noted in the status of claims and changer orders management. Also, the general information section clearly demonstrated areas that significantly affect the cost and time of the projects. While analyses and justifications were made for these problem areas, only a limited number actually offers room for improvement. For instance, it was noted that unit rate contracts, on average, experience significant increases in cost and time of a project, and that private ownership is associated with notable increases in the duration and cost. Also, it was noted and

explained that additional work is the most common factor for change orders. However, all these problem areas should only be kept in mind when entering into an industrial project. A solution cannot be generated for these matters, in the sense that it cannot be suggested that unit rate contracts must be modified, or that private ownership must be altered, or that the design phase should not proceed simultaneously with the construction phase in a cement plant or in an oil utility project to lessen the possibility of change orders in the form of additional scope of work. However, there are problems that indeed can be improved, such as the status of documentation, notifications, and so on.

The most noted problem areas discussed in the previous chapter that need improvement strategies are as listed herein. After the list of these problems is made, improvement strategies are furnished.

- ◆ Effective delays caused by the owner as an important cause of claims (figure 3-3)
- ◆ Deficient public contracts (section 3.3.2)
- ◆ Claim documentation and filing procedures (figure 3-5)
- ◆ Contract awareness for the site team (figure 3-7)
- ◆ “Fear of the consultant” phenomenon (section 3.4.1& figure 3-8)
- ◆ Oral change orders from the owner (section 3.4.2)
- ◆ Unified quantification of change orders (section 3.4.3)
- ◆ Egyptian and custom made contract conditions (section 3.6.2.2)

4.3 Suggested Solutions

4.3.1 Unified General Conditions to Address the ‘Fear of Consultant’ Phenomenon

One of the most effective solutions to proper claims management practices in the Egyptian industry, as a whole, and the industrial sector, in specific, is the alteration of the norms present with regards to proper claims notifications and documentation. As shown in this research, most of the problems associated with claims management stem from this cultural issue. Egyptian owners (especially public) and consultants must rid themselves of their feeling of offense whenever a claim notification is made, or minutes of meeting is objectively documented, or a correspondence is made to address an issue attributable to the owner. This is perhaps the most significant of all the problems facing not only claims management practices, but construction management in general in the Egyptian industry. This norm unfortunately became the norm for ineffective practices in our industry. The clearest illustration is the ‘fear of the consultant’ phenomenon. This phenomenon deteriorated the status of claims notifications by the contractor in a variety of projects, thereby opening the doors to haphazard verbal instructions that have no written confirmation. It has been mentioned earlier that several respondents stated that they waived their contractual rights of some issues for fear that asking for them would bruise their relationship with the owners and consultants and would, therefore, not make them candidates for future potential projects. It has also been shown that there is a

prevailing feeling of comfort in dealing with foreign companies than with Egyptian ones due to this attitude.

The solution to this significant problem is the formulation of contracts that would contain clearer clauses with regards to documentation. For instance, a clause regarding the procedures that are to be taken by both parties when documenting minutes of meeting should be addressed, or detailed clauses regarding regulation of correspondences flow should be added. In case of failure in fulfilling the contract conditions regarding these clauses by either party, then it should be clearly stated that the party at fault will have waived his right regarding the matter in question. Clauses regarding the owner's responsibilities should be enhanced to include new roles, such as the generation of only written instructions to the contractor. In the case of the necessity for a verbal instruction on the job site it is the owner's role to confirm within a stipulated number of days. Otherwise, the contractor is not contractually entitled to carry out the works. Obviously, this solution will not be pleasant to the owner. Therefore, there would be no means for it to be carried out unless it is enforced from a professional entity that practices high authority, such as the syndicate. It would be of great value, for instance, if this entity enforces a unified general conditions form for industrial projects (where Egyptian companies only are involved) that enforces the above-mentioned ideas. Although such a program would be resisted by a lot of parties in the beginning, it would help force the Egyptian industry to follow an objective, systematic approach with regards to proper claims notifications and documentation. Furthermore, it would gradually break down the walls and barriers that have for so long consumed the Egyptian industry.

With regards to the problem areas mentioned in the previous section, this solution would take care of the following:

- Deficient contracts in public projects
- “Fear of the consultant” phenomenon
- Oral change orders from the owner
- Egyptian and custom made contract conditions

4.3.2 Effective Delays Caused by the Owner & Equitable Adjustment

In the general causes of claims section (3.3.1), effective delays attributable to owner ranked second after change order claims as one of the most frequent causes of claims in the industrial sector. The essence of this problem is not the fact of delay itself, but rather, it is the fact that the contractor would be blamed for not completing the project in its initial planned time. The owner’s response in that case is usually the infliction of the liquidated damages penalty on the contractor without any consideration for the type of delays experienced. The solution to this problem centers on the equitable adjustment principle present in the changes clause in most contracts. The logic behind equitable adjustment centers on the ownership of the activity float. In several research, there had been a discrepancy over who is entitled the float – the contractor or the owner. In his article on ‘claimsmanship’, Zack (1993) presents both arguments and uses them as a form of claimsmanship that can be used by both parties vis-a-vis each other. The contractor would argue that in light of the equitable adjustment principle, he is entitled the restoration of the float of an activity that has been affected by an owner-caused delay.

On the other hand, some owners would argue that the float is the sole property of the owner and the contractor is not entitled any restoration in case it is affected. Zack's solution to the problem is a joint-ownership-of-float clause would be included in the contract documents. In that sense, both the contractor and owner can come to an agreement with regards to the effect of a certain owner-caused delay on the contractor's work progress in terms of the shared float. The problem of the Egyptian industry is that this idea of equitable adjustment is not given adequate attention in the first place although it is widely used in most contracts. Implementing Zack's idea of a joint-ownership-of-float clause in future contracts is a start to help alleviate the consequences of this problem.

4.3.3 Contract Awareness by Site Team

This problem has been recognized not only in this research, but rather, it was called for elsewhere in the world in various research, such as that of Vidogah and Ndekugri (1998) and Jergeas and Hartman (1994). It has become common practice for site engineers to commence the field work without carefully reading the contract documents. Not only does that cause the engineer to become unaware of the contractual scope of work and make him susceptible to easily executing the owner's verbal instruction at will, it also causes the engineer to lose several rights that he might have gained if a careful examination was made at the contract document. The obvious solution to this problem is that the site team must make themselves aware of what is in the contract documents. One means by which this would be achieved is through periodical orientations performed by

the company's contracting department. Such orientations would be treated as very important and as pre-requisites for any annual raises or bonuses.

Another solution could be the formulation of a checklist by the site team (or the company's contracting department), such as the one suggested by Jergeas and Hartman (1994) would be beneficial. This checklist, shown in table 4-1, would incorporate everything in the contract of a notice nature.

Type	Clauses in Contract Agreement	Clauses in General Conditions	Clauses in Supplementary Conditions	No. of Days for Notification
Delay/Time Extension				
Changes/Extras				
Acceleration				
Differing Soil/Site Conditions				
Disputes				

Table 4-1 Notice Requirement Checklist (Jergeas and Hartman, 1994)

4.3.4 Enhancement of Claims Documentation and Filing Procedures

The outcome of figure 3-5 was that most of the sample projects of this research did not have a unique filing system for the project documents. The filing system used in

most of the cases basically consisted of one file that contained all the documents of a certain project. Claims would be incorporated in one segment of the files. One of the simplest, yet effective, ways of filing claim matters has been addressed in the research of Thomas et al (1991) and Jergeas and Hartman (1994), where each claim matter would be filed in a separate file that contains correspondences, drawings, specifications and cost estimates. Restriction should not be made to claim issues alone, but rather, also to potential claim matters. A records management program might be a useful means to implement adequate control over the records in the entire organization, and not just claims (Hamilton, 1991). Another important form of records management is that of information technology systems within the organization. Electronic document management systems allow information stored in different forms to be linked and accessed in a flexible manner (Vidogah and Ndekugri, 1997). This can be very beneficial in the process of costing a certain claim that involves the input of various departments within the organization. Furthermore, it provides easy access to claim issues in terms of subject without having the need to go through stacks of papers in files.

Of course, all these documentation procedures would be difficult to implement in the Egyptian industrial sector, as the common trend for filing is to stick to the absolute minimum in terms of efforts for documentation. Although allocating an adequate budget for implementing information technology systems in Egyptian contracting companies may be viewed by many managers as not a priority, it can prove to be a strong factor in preventing the loss of significant amount of claims due to poor documentation. Figure 3-6 showed that 57% of the projects sampled in this research stated that there were

significant change orders lost due to poor documentation alone. Hence, the amount of money that would be saved would be significant.

4.3.5 Unified Quantification of Change Orders

The responses to the question if there existed an agreed-on basis for quantifying change order claims was unanimous in the sense that no one used such a system. In fact, most of the respondents did not understand the concept that this question carried, and hence, this question was misunderstood in the beginning. Fourie's article had to be shown and explained to most of the respondent's before an answer was obtained. It is therefore the author's opinion that implementing the quantification methods outlined in Fourie's article "Quantifying Costs Due to Change" (1993) would be a notable factor in the change order claims management improvement process. Basically, Fourie categorizes change order costs into method-related costs, costs related to activity duration, costs related to project duration and quantity-related costs. All these costs are broken down into equations so as to provide a general framework for future and general use. If these equations are approved by the owner at the beginning of the project, this would facilitate the process of claims quantification later on.

Another form of change order claim quantification was that outlined by Veenendal (1998). In this article, the authors suggest the tracking of the effect of each change order on the project schedule. Hence, this procedure offers the quantification of change orders in terms of time not money. Essentially, a critical path comparison is made every time a change is initiated and presented in table 4-2.

Activity	Impact Date	Delays to Early Start	Increase to Duration	Adjustment to Float Time	Total Variance from Baseline	Notes
Excavation						
PC fnd						
RC fnd						

Table 4-2 Critical Path Comparison Table (Veenendal, 1998)

4.4 Conclusion

Based on the problem areas identified in the previous chapters, several means for improvement were presented as a positive step to improving change order claims, and hence improving claims management in the Egyptian industrial construction sector. The first improvement strategy is for a professional body to adopt the idea of formulating a unified Egyptian general conditions form. Such a form would strictly address documentation and notification procedures for both the contractor and owner, as a means of guiding the industry away from the norms which have for so long negatively affected and impacted claims management in the industry. Such a strategy would also take care of the contractor's 'fear of the consultant' phenomenon and several other problem areas that have been documented in this research. Other strategies included the use of a joint-ownership-of-float clause in the contract so as to fairly compensate the contractor for delays that have been caused by the owner, a problem which was proven to rank second after change order claims as the primary cause for claims in the industry. In addition,

contract awareness by the site team through orientations carried out by the company's contracting department, more proper means of documentation and unified cost and time quantification methodologies of change orders were the remaining strategies for improving the management status of change orders and claims, in general, in the industry.

CHAPTER 5 : SUMMARY AND CONCLUSIONS

5.1 Introduction

This chapter will serve to briefly highlight and summarize the important points reached in the previous chapters. The final section shall pinpoint the limitations of this research and these should be kept in consideration for future research on the same topic.

5.2 Research Overview

The growing problem of claims has been given adequate attention worldwide. Several research works have attempted to analyze the causes of claims in the construction sector. The significant effect of claims on time and cost of projects have also been documented in several studies, one of which was by the authors Semple et al (1994) on the cost and time overruns associated with construction claims. The most noted cause of claims in general is change order claims, as documented by several research including Semple et al (1994) and the research by Diekmann and Nelson mentioned in the article by Burati (1993). Change order claims have had their mark on construction projects through their noted effect on labor efficiency and on the means by which they are handled in the construction industry as a whole. Qualification of change orders refers to notification procedures and knowledge of the contract. Quantification of change orders includes the means by which calculations are formulated and presented. Industrial projects in particular have been affected greatly by the increasing change orders

experienced by this type of industry. Quality degradation and decrease in labor efficiency are among the most noted problems in the construction industrial sector.

The Egyptian industrial sector has been known to experience significant problems with regards to claims propagation and management. However, very little research has been conducted to address and analyze these claims. It is that fact that has created the need to conduct a research that targets one of the most problematic areas in the Egyptian construction industry. The objectives of such an analysis starts by determining the status of claims management in the Egyptian industrial construction sector. Subsequently, through building on the literature review concerning the weight that change order claims have occupied, the second objective is to gain a closer insight on the status of change orders management. Finally, after arriving at the status of claims management in the industry and the associated key problem areas, a strategy for improvement of these problems is presented by applying the solutions that have been sought and implemented in projects outside Egypt, keeping in mind the nature of the Egyptian industry.

5.3 Research Conclusions

5.3.1 Objective # 1: Status of General Claims and Change Orders Management

The status of claims management in the Egyptian industrial construction sector has been proven to suffer from a variety of obstacles. The most common types of claims present have been reported to be change orders and effective delays attributable to the owner. This research documented that 54% of the projects surveyed experienced change

orders and 25% experienced delays attributable to the owner. Regarding the frequency of using claim notifications that are linked to contract clauses, around 75% of the projects stated that they use these notifications the majority of the times (between 75% to 100% of the time) – 67% of these projects stated that they use the contract-clause-notifications all the time. Nearly 10% stated that notifications are seldom used due to deficiencies in the contract of the project, all of which involved public ownership. Claim documentation procedures were also explored and this research showed that nearly 62% of the projects surveyed involved the site team being the initiator of the claim matter. Subsequently, the claims follow up and the associated contractual matters are passed on to the head office team. The main method of filing the claim documents is through a project file that contains all project data, including all project correspondences. Claims are only a portion of that file, a fact that indicates that claim issues do not have a special filing system for easy access. The groups forming this 62% claim documentation procedure were divided into two groups. The first, which formed 33%, used to claim via the head office after each claim matter is addressed. The remaining 29% used to compile all claims via the head office until the end of the project then present a unified claim. The latter form of claims demonstrated a form of ‘claimsmanship’ as illustrated by Zack (1993).

The next step within the first objective was to explore the status of change order claims, in specific. As mentioned earlier, change orders were documented by 54% of the projects in this research to be the most dominating cause of claims. The first aspect that was researched was the effect that poor documentation may have had on the loss of claims. Nearly 57% of the projects stated that there had been change orders lost due to poor documentation, most of which were attributed to the site team. When asked about

the documents that may have improved the records management status of the project, 29% of the projects stated that daily records by the site team is the key to reaching improvement in that aspect as it was named by some respondents to be the 'diary of the project'. Another 29% stated the contractual scope awareness by the site team is the means for improvement, for that will entail proper documentation practices. Oral change orders were the next focus of the research to evaluate the status of change order claims management, as it was documented that nearly 76% of the projects experienced frequent oral change orders, 50% of which had been lost due to lack of confirmation by the site team and due to the contractor's fear from upsetting the consultant. This phenomenon was a notable item of discovery in this research as it was reported by 33% of the projects that there is a prevailing feeling of fear from the consultant or expatriate from the site team. In addition, this phenomenon entails that change orders would be directly implemented with no recourse to the contract documents due to fear of jeopardizing relations with the consultant. The final parameter to evaluate the status of change orders management was to explore if a unified quantification system exists, such as that outlined by Fourie (1992). The result was that there are no such systems for quantification present.

5.3.2 Objective # 2 : Causes of Change Orders

The causes of change orders in the Egyptian industrial construction sector were then researched to achieve a deeper understanding about the most dominating factor that affects claims propagation in the industry. It was documented that nearly 66.7 % of the

projects stated that additional scope of work is the dominating cause of change order claims. One of the most logical interpretations given was that this was attributable to the simultaneous progress of the design and construction phases in most industrial projects due to the owner's keen interest to complete the project on time for maximum gain of profit. That would entail additional scope of work to be given to the contractor concerning the items that were missed by the designer in the tendering stage. The effect of design on change order propagation was then addressed to test Duttenhoeffer's (1992) theories that were presented in his article "Cost and Quality Management". The results indicated that the design aspect is not a dominant factor in change order claims propagation in the Egyptian industry. One of the main reasons for that is the 'fear of consultant' phenomenon.

5.3.3 Objective # 3: Identification of Cost/Time Overruns

The first step in achieving this objective was to analyze the general project information portion of the questionnaires to arrive at problem areas. The general project information section sought to pinpoint the factors that eventually led to significant cost and time increase in the projects. The results of this data showed that the characteristics that were directly associated with cost and time increases are:

- Cement plants, oil utility and power plants industrial projects
- Unit rate and unit rate/lump sum contracts
- Private ownership-projects

- Contracts that involved the Egyptian law of '89. Although custom-made contracts did not form significant effect, their stringent conditions and their current prevalence in the industry form the grounds for potential claim problems.

5.3.4 Objective # 4: Suggestions for Means of Improvement

The final objective of the research was to generate adequate means for improvement, in light of the information obtained from the previous three objectives and of the solutions published in the literature research. Strategies for better claims management practices were developed, and these strategies included the following:

- Addressing the prevailing notion in the industry to fear and get offended by written notifications. The step to achieving this is that a professional body would form stricter contract conditions with regards to documentation and that a unified Egyptian general conditions form be made and enforced by that body.
- The inclusion of a joint-ownership-of-float clause in the contract so that owner caused delays, which have been documented to be the second most dominant cause of claims in this research, may be improved.
- Addressing the issue of site contract awareness, the site team must practice more contract awareness and this can be achieved through periodical orientations performed by the contracting or legal department of the company, which must be attended by the site personnel.

- Proper claims quantification procedures, such as the presentation of claim cost breakdown formulae, similar to those by Fourie (1993) prior to the commencement of the works, and the monitoring of the effect of change orders during project execution by using the scheduling techniques suggested by Veenendal (1998).
- Finally, documentation procedures for claims should be dramatically improved. One of the means for improvement in that area is the filing of each claim matter into a separate file that would include claim correspondences, drawings, specifications and cost estimates. The second means for improvement is the implementation of information technology in the documentation process within the organization. This would facilitate the flow of information within the organization and would allow easy access to all claim-related information.

5.3.5 Comparison between Literature Review and Thesis Research

In conclusion to this chapter, a comparison between the results and findings in this thesis research with those from the literature review is furnished in figure 5-1. The purpose of this comparison is to illustrate the stance of the results and findings of this research as opposed to those in the literature review. It is worthy to note that the comparison in figure 5-1 summarizes all points of agreement and disagreement present between this thesis research and the literature research, and that all of these points were explained and discussed in detail during the course of this research.

AGREEMENTS

- Change orders are the predominant claim type in industrial projects (Diekman and Nelson, 1985)
- The ‘reservation of rights’ approach is one of the most common types of claimsmanship present (Zack, 1993)
- A lack of contract awareness is present in the site team of a project [(Jergeas, 1994) & (Vidogah and Ndekugri, 1998)].
- Private-owned projects cause the most cost and time increases (Semple and Hartman, 1994)
- Claims can cause up to more than 100% increase in a project’s cost and duration (Semple and Hartman, 1994).

DISAGREEMENTS

- Design changes are the prevailing type of deviations in industrial projects (Burati, 1992)
- Poorly coordinated designs leads to dramatic increase in the number of claims filed by the contractor (Duttenhoeffer, 1992)
- Adversarial relationships with the consultant leads to significant effects on change order claims propagation (Duttenhoeffer, 1992)

Figure 5-1 Thesis and Literature Review Results Comparison

5.4 Limitations and Suggestions for Future Research

This research contains certain limitations that should be kept in mind for future research reference. First, caution is to be taken concerning the applicability of these findings to claims management in the Egyptian construction industry as a whole. This research targeted the industrial construction sector only (where 77% of the sample projects were characterized as fast track) and not residential or commercial industries. Although there is scarcely any means present by which a proportion of the industrial sector to the Egyptian construction industry would be made, it can be safely deduced that the proportion does not exceed 25%. This rough estimate was used by many respondents to estimate the Egyptian industrial work volume. Hence, application of the results in this research to the remainder of the Egyptian construction industry is limited. For example, although most of the respondents in this research occupied contract management roles, this trend is not likely to be observed in the traditional Egyptian construction industry, which might not have such roles in the first place. However, certain conclusions and suggestions in this research can be applicable to other sectors. For example, the need for better documentation management and more contract awareness by the site team are all suggestions that should be kept in mind for all Egyptian construction sectors. On the other hand, the types of claims prevailing in the industrial sector are very likely to be different than those in the various other construction sectors in Egypt. In fact, change orders might not be the most dominant type of claim, as this research has connected them to the fast track nature of the industrial construction sector. Therefore, it is suggested

that future research works would explore the status of claims management in the various other construction industries.

Another limitation of this research is that it was studying change orders claims in specific due to the fact that it is the predominant claim factor. Therefore, it would be beneficial if a more detailed research would be conducted on one or more of the other claim factors listed for claim causation, such as inadequate bid information or unforeseen conditions. The door for research in claims management in Egypt is wide open due to the increasing number of problems experienced in that area of construction management. An interesting and important topic that could be addressed in a thesis research is the assessment of claims management practices in public companies, as this research indicated that these companies are the most susceptible to deficient contracts formulation and to sensitivities regarding documentation and notification procedures.

Finally, the problem areas concerning the general project information in this research offer significant room for study. For example, this research did not focus on why unit rate contracts cause such a high increase in project cost and duration, or why privately owned projects experience similar cost and time escalations. Similarly, research can be performed on the various industries within the industrial sector. It would be interesting to understand, for example, the reason for the increase in cost and duration associated with the cement or oil utilities industry. Another open area for research is gaining a further understanding of the Egyptian Law of '89 contract and why it was associated with this notable increase in cost and time in most projects of this research.