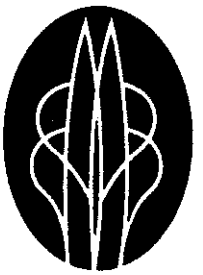

UNIVERSITI
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PETRONAS

Investigation on the Causes of Delay in Construction Projects

By

Karim Medhat Makram Riad

A project dissertation submitted in partial fulfillment of the requirement for the

BACHELOR OF ENGINEERING (HONS)

(CIVIL ENGINEERNG)

September 2011

Universiti Teknologi PETRONAS

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CERTIFICATION OF APPROVAL

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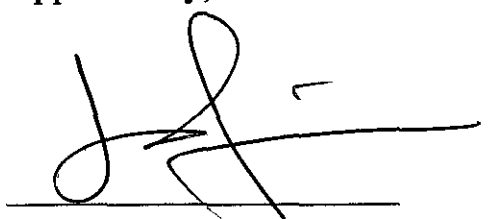

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TRONOH PERAK

September 2011

CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this project, that the original work is my own except as specified in the references and acknowledgements, and that the original work contained herein have not been undertaken or done by unspecified sources or persons.

Karim Medhat Makram Riad

ABSTRACT

Construction management in general & construction time in particular are part of important aspects that are required in the industry of construction projects. The importance of management is to ensure that all the planning is well executed to complete the project. The importance of construction time lies in in managing the activities of the project, so that it won't be delayed after the deadline. Delays are crucial industry breakers as they can have effects on money and resources.

This research is focusing on identifying some factors that contribute to delay and their effects on construction projects. To be specific, the case study is focusing on the delay factors and effects in **"The Proposed Design Construction And Completion Of 3 Star Hotel And Office Tower On Plot Z10, Precint 1, Wilayah Persekutuan Putrajaya, Malaysia"** project and **"The New Petrojet Head Quarters, 90th Street, Fifth Avenue, Cairo, Egypt."** project. The methodology of the research is to select and identify the projects, site observation, data collection, structured interview with the staff and in the end analyzing the data from the respective interviews using the average index calculation.

The result of this research found that there are 9 main groups of factors that contribute to delay in both projects such as changes and variations, contractual relationships, political issues and many more. The factors were analyzed and discussed and the discussion led to the exploration of the delay effects in both projects. At the end of the research, several recommendations have been proposed to make future researches on this subject more viable and accurate.

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Chapter 1

Introduction

1.1 Background of the Study.

Time is define as the duration, considered independently of any system of measurement or part of duration, whether past, present, or future; a point or portion of duration; as, the time was, or has been; the time is, or will be (Brainy quote,2009). Time is described as a basic component of the measuring system used to sequence events, to compare the durations of events and the intervals between them, and to quantify the motions of objects. It is also being described as a period of time considered as a resource under one's control and sufficient to accomplish something (Wikipedia, 2009).

Construction time is been acknowledged by construction researchers and industry practitioners over the past three decades as one of the most important performance criteria of many successful building projects (Chan and Chan, 2003). Realistic construction time is now increasingly important because it often serves as a crucial benchmark for assessing the performance of a project. Time overrun over the last three decades is been an issue in the construction industry, it's been reported that there had been 50% to 80% delays on 1627 world bank sponsored projects between 1974 and 1988, together with an average of 23.2% time overrun on UK government construction projects from 1993 to 1994 (Chan & Kumaraswamy, 2002)

Construction delays are for the most part costly, and completing projects on time is beneficial to all project parties. Therefore, it is essential to

identify the actual causes of delay in order to minimize and avoid the delays and their corresponding expenses. The construction sector is counted as one of the most active sectors affecting the Egyptian economy to the extent that about 45% of the funds allocated for the national development plans in Egypt since 1981 were allocated to the construction sector (Ahmed 2003). With the economic development currently taking place in Egypt, building construction contributes to a large portion of the construction sector.

Based on several researches that have been done, the delay problems are one of the most important problems in the construction industry. Delays occur in every construction project in Malaysia and the level of these delays varies considerably from project to project. Some projects are only a few days behind schedule; some are delayed by over a year. It is essential to define the actual factor causing the delay in order to reduce the numbers of activities contribute to delay in any construction project.

1.2 Problem Statement.

Nowadays the Construction Sector in Malaysia is at its peak growth, providing 3.5% to Malaysia's GDP in 2009 & that number has increased significantly in 2010 & 2011 (The Star, November 2009), there are more up and coming companies all around Malaysia that are using that growth to their advantage. Moreover, with opportunities arising all over the region and foreign contracts being secured in the Middle East and India, the construction sector is expected to outperform its status in the coming years (The Edge, January 2010).

With big opportunities come big difficulties, as there are still projects that are having delays in their submission deadline with delay of some of these projects is even extended to two or three years in time. These time management issues causes the industry to not operate at its maximum potential and the growth of the industry will always be vulnerable to these matters if there is no serious study and actions are taken to face these issues.

Furthermore, these time management issues are affecting the clients, the companies involved and the costumers. In the past when projects were delayed, the money's value remained steady so no big burden was felt over the delayed period. Now with the value of money becoming so high rising upwards, time has become a sensitive concern. The rate of inflation erodes the profit of the contractor and hence longer he has to stay, more sensitive he becomes to the time factor and gives up in end putting delay-damages claims. For the companies, the more time the project goes out of schedule the more resources are being used in a non-efficient manner the more money is being drained from them. As for the costumers, they get really harmed from these situations when then buy their desired units in unfinished projects that tend to go through uncertain time frames submission dates.

Therefore, since there are so many problems caused by the mismanagement of the projects' time frame, this research will go through the reasons behind these problems so that any liable party that gets involved in a project can undergo several actions to deliver the project on time.

1.3 Objectives.

Three main objectives have been set to meet the outcome value of this research:

- To identify the reasons behind the delay in construction projects.
- To rank the causes of delay in construction projects.
- To identify the effect of delay on construction projects

1.4 Scope of study.

This research will be focusing on the case study of two projects, one in Malaysia and the other in Egypt. The projects are selected based on several factors affecting these two projects in terms of time management.

Since there will conducted interviews with members of the staff, therefore the data collection will concentrated on site activity so that it can be analyzed in the research. The data is only relevant for these two projects; however the product of this research can be used in other construction projects.

In the interest of the research, on-site progress monitoring will be achieved. There representatives from the respective companies will assist in giving opinions and explanations during the site visit to accommodate the monitoring of documents, staff and technical work on-site.

1.5 Background of Case Study.

The two main projects that have been selected for this case study are a hotel and an office tower in Malaysia, and a construction company headquarters in Egypt. The following tables show all the details related.

Table 1.1: Details of Malaysian Project

Contract Title	**The Proposed Design Construction And Completion Of 3 Star Hotel And Office Tower On Plot Z10, Precint 1, Wilayah Persekutuan Putrajaya.**
Contract No.	**BDG/COM/P1/Z10/CONTRACTOR/09-0045**
Nature of Project	**Design and Build Lump Sum Fixed Price based on Employer's Requirement (Design Brief, Performance Specifications, Scope of Works and Drawings)**
Contract Sum	**RM 147,360,000.00**
Defects Liability Period	**24 Months from CPC**
Liquidated & Ascertained Damages	**RM52,000.00 (LAD Imposed Per Day) Not Exceed 10% Of Contract Sum (Maximum Lad Imposed)**
Date of Award	**28th September 2009**
Date of Site Possession	**07th October 2009**
Date of Completion	**06th October 2012**
Period of Interim Claim	**Monthly**
Period of Honoring of Certificates	**Within 30 Days Upon the ER's Certification**

Figure 1.1

Figure 1.2

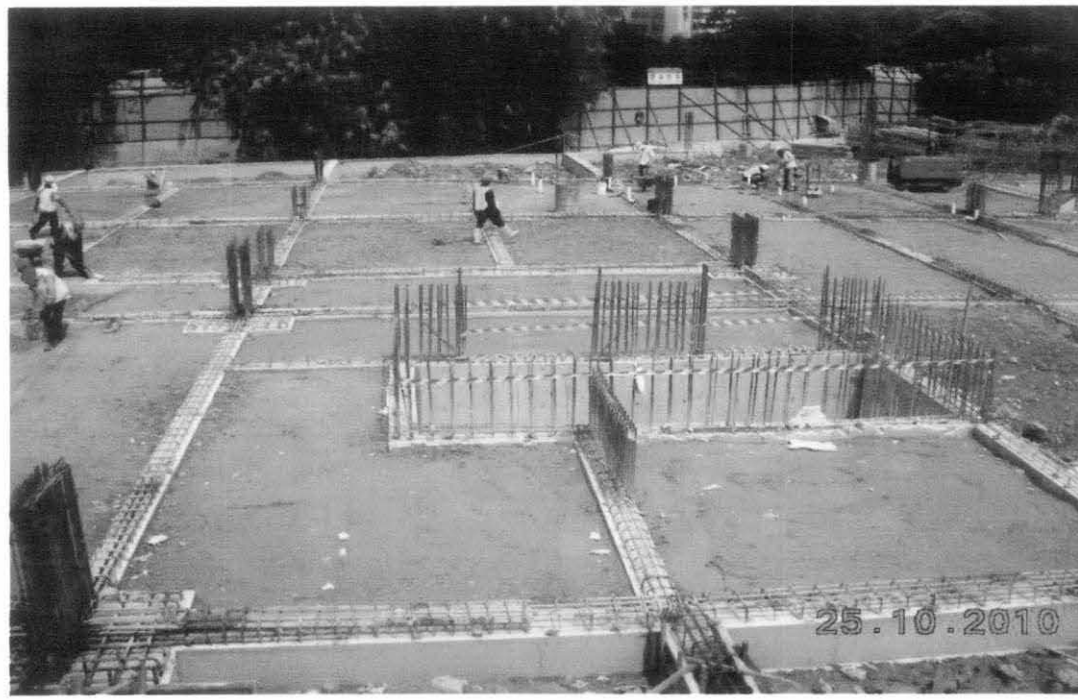

Figure 1.3

Figure 1.4

Table 1.2: Details of Egyptian Project

Contract Title	**The New Petrojet Head Quarters, 90th Street, Fifth Avenue, Cairo, Egypt.**
Nature of Project	**Design and Build of One Main Cylindrical Building With Two Wing Attached Buildings.**
Contract Sum	**RM 150,000,000.00**
Date of Site Possession	**10th April 2009**
Date of Completion	**10th April 2013**

Figure 1.5

Figure 1.6

Figure 1.7

Chapter 2

Literature Review

2.1 OVERVIEW

Time management is an important factor in the construction industry, its magnitude being varied considerably from project to the other. Construction time management is been acknowledged by construction researchers and industry practitioners over the past three decades as one of the most important performance criteria of many successful building projects (Chan and Chan, 2002).

According to (Xiao and Proverbs, 2002) international comparisons of contractor performance can provide robust benchmarks for contractors in different countries and allow them to learn from one another. In the study, a survey-based approach that considered construction time, time certainty, extent of delay, and client satisfaction was used in evaluating and comparing the construction time performance of contractors in Japan, the UK and the US. In the survey, Japanese contractors performed significantly better than their UK and US counterparts. UK contactors were superior to US contractors in construction time and extent of delay, and inferior in time certainty and client satisfaction, but without any statistically significant differences.

There is no consensus on the identification of the factors which affect stipulated, planned or achieved construction times of building projects due to the fact that researchers have largely viewed the subject from diverse perspectives (Nkado, 1995). Delay of project completion is a major problem in construction that often leads to costly disputes and acrimonious relationship between the parties involved and while it may be unrealistic to believe that all causes of delay can be brought under control, it would be sensible to determine the most important delay factors

so that efforts can be made to control these factors (Al-khalil and Al-Ghafly, 1999b).

(Mezher and Tawil, 1998) conducted a survey in Lebanon in order to find the main causes of delay in the construction industry. They identified 64 causes of delay through literature research and local interviews with owners, contractors and architectural or engineering firms, these causes were categorized in 10 main groups: materials, manpower, equipment, financing, changes, government relations, project management, site conditions, environment and contractual relationships. The study was to assess the relative importance of each of the causes. The survey revealed that the owners agrees that the most important delay factors were financing and the scheduling of subcontractors, the most important delay factors according to contractors were contractual relationship and design changes by owners and finally the most important delay factors according to architectural or engineering firms were project management and rated shopping drawing.

(Assaf et al., 1995) outlined the main causes of delays in large building projects and their relative importance. In their study, they found that 56 causes of delay exist in Saudi construction projects. The most important delay factors, according to the contractors, were preparation and approval of drawings (delays in contractor payment by owners and design changes). The views of the architects and engineers were that delays were caused by cash problems during construction, the relationship between the contractors and a slow decision-making process on the part of the owners. Finally, the owners attributed delays to design errors, labor shortages and inadequate labor skills, as cited by (Alaghbari et al, 2007).

In Hong Kong (Chan and Kumaraswamy, 1995) conducted a survey to evaluate the relative importance of 83 potential delay factors in construction projects. They found that the five and common factors to be; poor risk management and supervision, unforeseen site conditions, slow decision making involving all project teams, client-initiated variations and necessary variations of works.

(Odeh and Battaineh, 2002) studied causes of construction delay in Jordan. In their study presents the results of the survey which indicate that contractors and consultants have agreed that the owner interference, inadequate contractor experience, financing and payments, labor productivity, slow decision making, improper planning, and subcontractors are among the top ten most important factors.

A research studied the factors contributing to delay and cost overruns in Ghana groundwater construction projects. The study revealed the main causes of delay and cost overrun as monthly payment difficulties from agencies, poor contractor management, and problem of material procurement, poor technical performances, and escalation of material prices (Frimpong et al., 2003).

(Aibinu & Jagboro, 2002) examined the effects of delays and impact of delays on the delivery of construction projects. Time and cost overruns were identified as adverse effects of delay and that minimizing the adverse effect of delays could be achieved through acceleration of site activities coupled with improved clients' project management procedures and the inclusion of an appropriate contingency allowance in the pre-contract estimate, as cited in (Koushki et al, 2005).

Summarily different researchers have highlighted various factors affecting the time performance of building projects in the construction industry in some developing countries and examined their frequency, severity and importance, many of which are similar and could be attributed mainly to the clients, contractors and consultants of construction projects. Each one of them in a way

contributes to the delays in the projects. Some other researchers have also attributed the method of procurement used for a project as the cause of time overrun. As this factors influence time-overrun they also affect the cost-overrun of construction projects.

To examine the effects of delay, a research was prepared by (Oseghale et al, 2008) concludes that delays in the execution of building projects lead wastage & underutilization of resources and increase in the final cost of projects due to idle and unproductive time remobilization. One major effect of delay to the contractor is on the area of indirect cost incurred on site. The nature of most indirect expense items; such as salaries of key staff, plant and equipment on site increases as long as the project experience delays. It is reasonably adequate to say that indirect cost increases directly with time.

2.2 TYPES OF DELAY

Delays can be grouped in the following four broad categories according to how they operate contractually:

1. compensable delays
2. non-excusable delays
3. excusable delays
4. concurrent delays (Ahmed et al., 2003)

2.2.1 Compensable delays

Compensable delays are those that are generally caused by the owner or its agents. The most common form of compensable delay is inadequate drawings and specifications, but compensable delays can also arise from the owner's failure to respond in a timely fashion to requests for information or shop drawings, owner's changes in design or materials, and owner's disruption and/or change in the sequence of the work. The contractor is entitled to both additional money and additional time resulting from compensable delays (Alaghbari, 2005).

2.2.2 Non-excusable delays

Basically, these delays are caused by contractors or subcontractors or materials suppliers, through no fault of the owner. The contractor might be entitled to compensation from the delaying subcontractor or supplier, but no compensation is due from the owner. Therefore, non-compensable delays usually result in no additional money and no additional time being granted to the contractor (Alaghbari, 2005).

2.2.3 Excusable delays

Excusable delays, also known as "force majeure" delays, are the third general category of delay. These delays are commonly called "acts of God" because they are not the responsibility or fault of any particular party. Most contracts allow for the contractor to obtain an extension of time for excusable delays, but not additional money (Alaghbari, 2005).

2.2.4 Concurrent delays

If only one factor is delaying construction, it is usually fairly easy to calculate both the time and money resulting from that single issue. A more complicated – but also more typical – situation is one in which more than one factor delays the project at the same time or in overlapping periods of time. These are called concurrent delays (Alaghbari, 2005).

2.3 DELAY RESPONSIBILITY

Ahmed et al. (2003) claimed that the issue of responsibility for delay is related to whether the contractor is awarded or is liable for costs and additional time to complete the project. The categories of responsibilities are:

- Owner (or agent) responsible – contractor will be granted a time extension and additional costs (indirect), where warranted

- Contractor (or subcontractor) responsible – contractor will not be granted time or costs and may have to pay damages/penalties

- Neither party (e.g. "act of God") responsible – contractor will receive additional time to complete the project but no costs will be granted and no damages/penalties assessed

- Both parties responsible – contractor will receive additional time to complete the project but no costs will be granted and no damages/penalties assessed.

2.4 CAUSES OF DELAY

There are two types of causes for delay in construction projects:

(1) External causes

(2) Internal causes

Internal causes of delay include the causes arising from four parties involved in the project. These parties include the owner, designers, contractors, and consultants. Other delays, which do not arise from these four parties, are external causes for example from the government, materials suppliers, or the weather (Ahmed et al, 2003).

Ahmed et al. (2003) and Alaghbari (2005) mentioned the possible following factors causing delays in construction projects in Malaysia:

2.4.1 Contractor's responsibility:

- delay in delivery of materials to site
- shortage of materials on site
- construction mistakes and defective work
- poor skills and experience of labour
- shortage of site labour
- low productivity of labour
- financial problems
- coordination problems with others
- lack of subcontractor's skills
- lack of site contractor's staff
- poor site management
- equipment and tool shortage on site

2.4.2 Consultant's responsibility:

- absence of consultant's site staff
- lack of experience on the part of the consultant
- lack of experience on the part of the consultant's site staff (managerial and supervisory personnel)
- delayed and slow supervision in making decisions
- incomplete documents
- slowness in giving instructions

2.4.3 Owner's responsibility:

- lack of working knowledge
- slowness in making decisions
- lack of coordination with contractors
- contract modifications (replacement and addition of new work to the project and change in specifications)
- financial problems (delayed payments, financial difficulties, and economic problems)

2.4.4 External factors:

- lack of materials on the market
- lack of equipment and tools on the market
- poor weather conditions
- poor site conditions (location, ground, etc)
- poor economic conditions (currency, inflation rate, etc)
- changes in laws and regulations
- transportation delays
- external work due to public agencies (roads, utilities and public services)

Chapter 3

Methodology

To conduct this research, the causes behind the mismanagement of the time frame must be identified and the impact of these causes must be addressed. To follow through with the research, an on-going building construction project must be selected. The following figure shows the summary of the methodology.

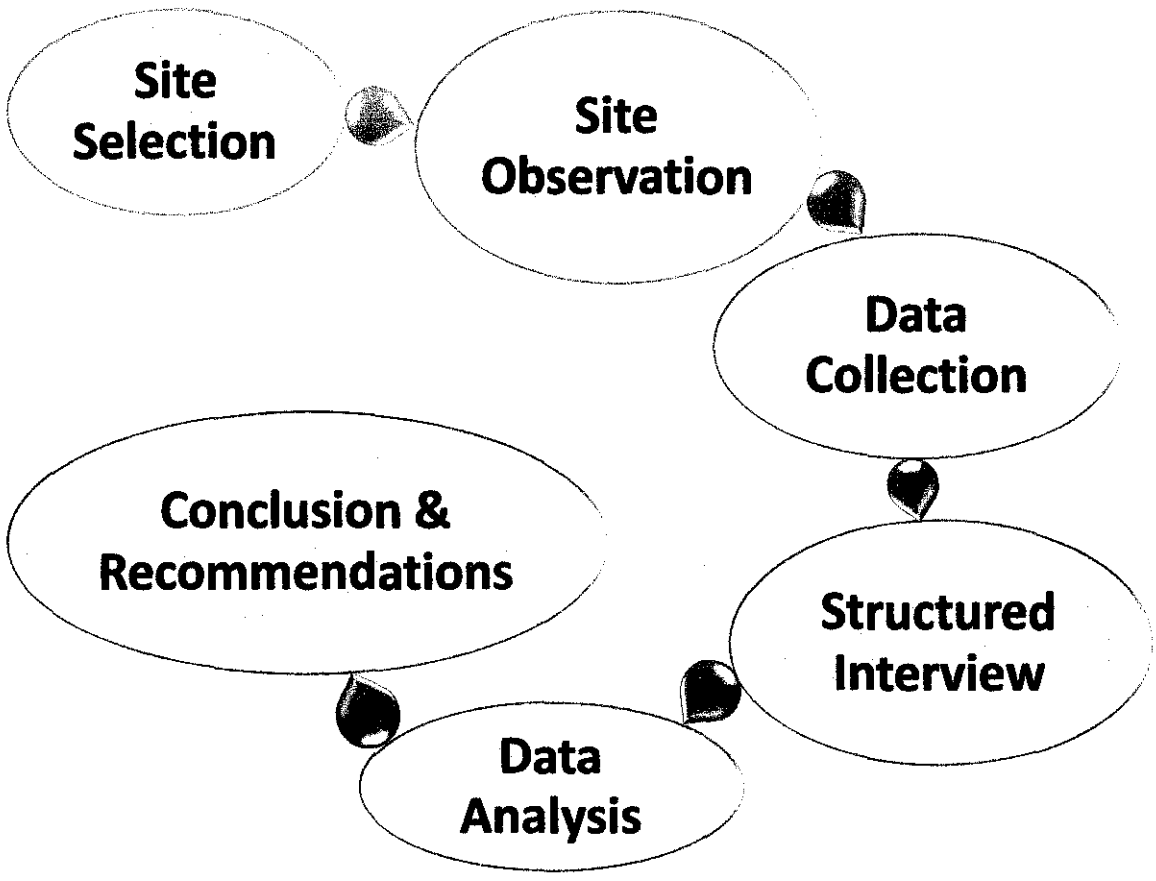

Figure 3.1: Methodology

3.1 Selection of the Construction Site

To select a suitable construction site for this research, there are several factors that need to be considered.

- The projects should have encountered several time management issues in any phase of its construction.
- The project should be a currently an on-going project, so that the data collection can be practical and realistic in making this research.
- The project should have a considerable big budget in comparison to other standard projects, preferably more than RM 10 Million budget. So that the project's management is expecting a strict specific time frame for the project & that the delay in the project's submission is not acceptable under any circumstance, therefore the project's time management in extremely important.

3.2 Data Collection

Afterwards, a series of questions will be prepared before the interview session to assist the respondents in giving their comments. Every question must be rated based on their opinion. A set of questions will be handed with several sections divided based on the relevant type of information need to be collected later. The questions survey will target the group of staff working on the project and who are going to be interviewed subsequently, such as:

- Board of management.
- Consultants.
- Site supervisors.
- Engineers.

- Contractors.
- Workers.

Documents of site activity need to be collected to ensure that the research is more reliable, as the data in the documents can give a picture about all the activities on site that might help with the research. To assume that there is an effective time management system, several relevant documents should be collected; such as:

- Company's profile (Finance, Track record and Manpower).
- Progress report.
- Summary of changes in design, drawings, material and contractor.

3.3 Questionnaires

The questionnaires were handed to a selective sample from the population working on both projects. The intent was to cover as much as professionals as possible working on the projects. In the end, 23 people were interviewed from the Malaysian project and 35 people were interviewed from the Egyptian project.

Questions from the questionnaires were included to inquire about the respondent's occupation, whether if they have face any kind of delay on the project, how do they measure such delay, how do they control the delay and how many site meeting do they conduct among other questions.

The objectives of the questionnaires were:

- To identify relevant factors that contributes to the delays in the building construction sector.
- To identify the effect of delay in the building construction sector.
- To predict whether the project will be completed at the specific time or not.

3.4 Data Analysis

Based on the data gathered, the data will be analyzed based on several points of view.

The analysis is based on the qualitative measurement or ranking system. Some calculation will be conducted to get the average index.

The Average Index Formula:

$$\textbf{Average Index (AI)} = \sum (ß \times n)/ N$$

ß = weighing given to each factor by respondents

n = frequency of the respondents

N = total number of respondents

With the rating scale as below (Majid & McCaffer, 1997)

1 = Totally disagree $(1.00 \leq \text{Average Index} < 1.50)$
2 = Disagree $(1.50 \leq \text{Average Index} < 2.50)$
3 = Neutral $(2.50 \leq \text{Average Index} < 3.50)$
4 = Agree $(3.50 \leq \text{Average Index} < 4.50)$
5 = Strongly agree $(4.50 \leq \text{Average Index} < 5.00)$

3.5 Gantt Chart

A Gantt chart was formulated to schedule the time frame of activities for the preparation of this research.

Table 3.1: Gantt chart

Item	May 2011	June 2011	July 2011	Augus t 2011	Sept 2011	Oct 2011	Nov 2011	Dec 2011	Jan 2012
Selection of project Topic									
Preliminary Research Work									
Submission of preliminary report									
Searching for suitable construction projects									
Project's overview data collection									
Compiling of interim's report									
Submission of interim's report									
Oral presentation									
Site visits									
Data collection									
Project's document compilation									
Submission of progress report									
Data analysis									
Poster exhibition									
Submission of dissertation									
Submission of technical paper									
Final presentation									
Submission of final report									

CHAPTER 4

RESULTS AND DISCUSSION

4.1Results

4.1.1 AVERAGE INDEX: FACTORS CONTRIBUTING TO DELAY (Malaysian Project)

Table 4.1 below shows the average index of every factor that causes the delay. It is based on the respond from respondents.

Table 4.1: Malaysian Project's Average index

Factors	Average Index	Total Average index	Ranking
Work Environment			
Hot weather	2.28	3.13	8
Rain effect	3.64		
Insufficient available utilities	3.48		
Social and culture	3.11		
Project Financing			
By main contractor	4	3.44	7
Progress payment	3.75		
Partial payment	3.53		
Social and culture	2.51		
Manpower Allocation			
Shortage of labour	4.05	3.81	6
Labour skill	4.06		
Labour injuries	3.39		

Labour and management relationships	3.75		
Change of Issue		4.24	**1**
By owner/agent	4.18		
Design error	4.43		
Foundation condition	4.06		
Mistake in soil investigation	4.30		
Contractual Relationships		3.98	**3**
Conflict between contractor and consultant	3.76		
Difficulty of coordination	3.99		
Insufficient communication	3.99		
Poor contract management	4.19		
Equipment and Tool		4.04	**2**
Shortage in number	4.20		
Unskilled operators	4.11		
Lack of high-technology equipment	3.75		
Slow delivery	4.11		
Scheduling and Control		3.85	**5**
Preparation and approval of shop drawing	3.77		
Inspection and testing procedure	3.33		
Accident during construction	3.99		
Lack of work monitoring	4.32		
Materials Used		3.92	**4**
Shortage in number	3.87		
Materials changes in types & specification during construction	3. 85		
Late delivery of materials	4.09		
Damage of materials	3.87		

Political Issues			
Change in the upper hierarchy	0	0	9
Workers on strike	0		
Turbulence in the area of construction	0		
The country is in a state of turmoil	0		

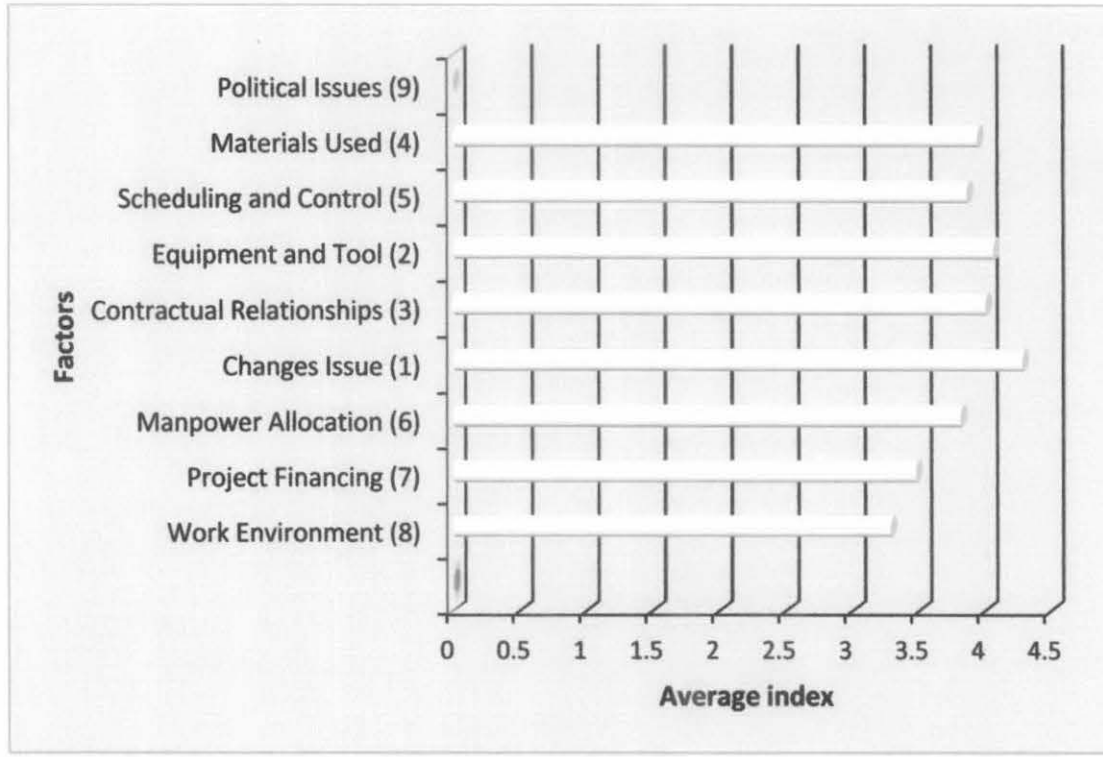

Figure 4.1: Malaysian Project's Factors Comparison

4.1.2 AVERAGE INDEX: FACTORS CONTRIBUTE TO DELAY

(Egyptian Project)

Table 4.2 below shows the average index of every factor that causes the delay. It is based on the respond from respondents.

Table 4.2: Egyptian Project's Average index

Factors	Average Index	Total Average index	Ranking
Work Environment		2.47	9
Hot weather	1.82		
Rain effect	0		
Insufficient available utilities	2.54		
Social and culture	3.04		
Project Financing		3.77	7
By main contractor	4.18		
Progress payment	3.76		
Partial payment	3.62		
Social and culture	3.51		
Manpower Allocation		3.28	8
Shortage of labour	3.12		
Labour skill	3.43		
Labour injuries	3.32		
Labour and management relationships	3.26		

Change of Issue		4.31	1
By owner/agent	4.57		
Design error	4.13		
Foundation condition	4.32		
Mistake in soil investigation	4.22		
Contractual Relationships		4.10	**2**
Conflict between contractor and consultant	3.96		
Difficulty of coordination	4.13		
Insufficient communication	4.09		
Poor contract management	4.22		
Equipment and Tools		3.89	**6**
Shortage in number	3.96		
Unskilled operators	3.91		
Lack of high-technology equipment	3.71		
Slow delivery	3.98		
Scheduling and Control		3.96	**4**
Preparation and approval of shop drawing	3.82		
Inspection and testing procedure	3.45		
Accident during construction	3.99		
Lack of work monitoring	4.57		
Materials Used		3.91	**5**
Shortage in number	3.87		
Materials changes in types & specification during construction	3. 85		
Late delivery of materials	4.07		
Damage of materials	3.87		

Political Issues			
Change in the upper hierarchy	3.33	4.03	3
Workers on strike	3.92		
Turbulence in the area of construction	4.21		
The country is in a state of turmoil	4.67		

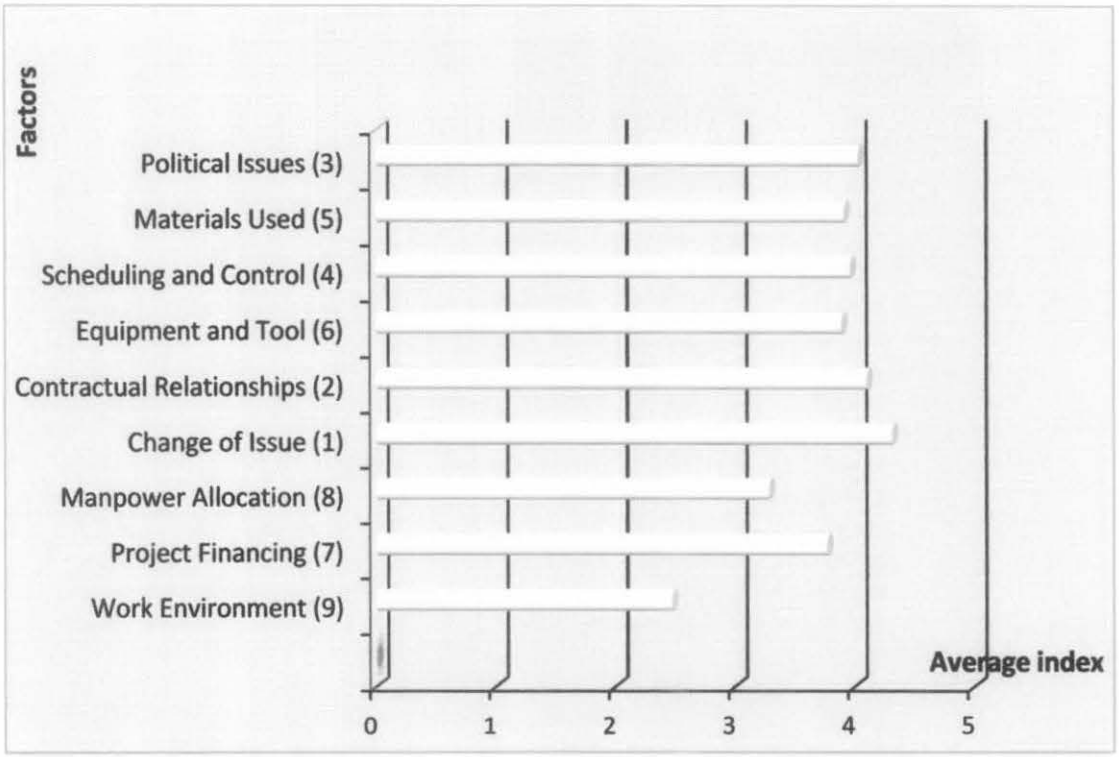

Figure 4.2: Egyptian Project's Factors comparison

4.2 Average Index

4.2.1 Highest average index (single factor)

In Malaysia, we can conclude from the average index that the design error is the main problem that contributes to the delay. With the index 4.43 out of 5 shows that how serious this problem in this project. It almost reaches strongly agree rating by the respondents. Based on the interview, there was a major delay in the design development stage for architectural drawings which in turn affected the design process for the civil and structural drawings. The delay was in terms of review, approval and confirmation. At one point on the 25th of October, the reviewing and approval stage of the architectural drawing was at 9% in progress while it was supposed to be at 100%. The C&S drawings were also delayed and affected the physical progress at site. Also on the 25th of October, the reviewing and approval stage of the C&S drawings was at 19% progress while it should have been at 100%.

In Egypt, the biggest problem that contributed to the delay was the Egyptian revolution on the 25th of January and its aftermath, with an index of 4.67 out of 5. The revolution left Egypt in a state of turmoil and chaos which had many drawbacks on the construction industry. Almost all of the respondents agree that if it wasn't for the revolution, the project would have been completed prior to its submission date. Everyone sited that because of the revolution and its aftereffects which caused a great number of workers from different companies to go on strike demanding a pay raise, shortage of investments due to the lack of liquidity, a state of insecurity in the construction area and that's even without mentioning the 20 days where there was no actual progress due to the rising state of the revolution.

4.2.2 Highest average index (group factor)

The highest average index in Malaysia and in Egypt for the group index is the change of issues. Under the change of issues, there are several factors related which are changes by clients or its agent, design error, foundation condition and mistake in soil investigation. Change of issues is very common in construction industry. To eliminate this problem is impossible but the best way to counter this problem is to minimize the possibility. Changes out of contractor control are considered as accepted to happen. But last minutes changes by client should be reduced to keep the work progress smoothly. One of the suggestions is that the related party should clearly know its job scope and everybody know their limit and responsibility in work. It can be made during the contract preparation phase where everybody understands the contract. Sometimes it is not fair for the contractor to follow all the last minutes changes made by the client. Other than that, every party should minimize the problems occurring in construction because of the possibility to have any changes is high when any party makes a mistake.

4.2.3 Overall average index (group factor)

In Malaysia, it shows from the index that the lowest group of factors is the political issues with the average index of 0 out of 5. Political issues are not a problem in Malaysia as the country is pretty stable in terms of politics & it almost has no effect on the construction industry. Political issues are followed with the work environment factor which accumulated an average index of 3.13 out of 5. Most of the respondents are not complaining about the work environment especially when it's related to the weather. Meaning, they are satisfied with the work environment and the staff are successful to create a good environment for work. The gap between each group of factors is not much. It can be summarized that there are lots of factors that contribute to the delay.

In Egypt, it is shown that the lowest group of factors from the index is the work environment followed by the manpower allocation. There aren't any major problems with the weather or the type of the working environment in Egypt as it only rains once or twice a year, also the workers get along well and have a healthy and friendly working environment. Manpower allocation in Egypt is also not a problem due to the fact that there is no shortage in any skilled kind of labor and usually there is a degree of respect in the relationship between the labor force and the management which allows them to get along without any key problems.

4.2.4 Each factor is interrelated

Even though the factors are categorized under different group, most of them are still interrelated with each other. For example the change of issues will affect scheduling and control. Indirectly, it also will affect contractual relationship. Due to that, some of the factors might not be of any relevance to be considered as contributing to the delay.

4.3 EFFECTS OF DELAY

4.3.1 Extension of time

The main problem of delay faced by the contractor is they need to extend the construction period. Each of the work normally effected when one of the work element is delayed. For work that can be completed in few days may delay for several weeks or several months in Egypt's case. Combining the overall expected delay problem can give an early prediction when the project will be completed. The contractor will apply extension of time (EOT) from client if the possibility to finish the work is low. The client will consider the reason and relevancy before awarding EOT or else the contractor need to pay Liquidated Ascertain Damage (LAD)

4.3.2 Additional cost to complete the project

Several cases related to the additional cost are changing material used, extra payment for manpower, and discrepancies in the contract. Main contractor and sub-contractor are the main parties that face the problem. They need to spend extra money if the changes that happen are either caused by them or the client. The variation order issued by contractor and sub-contractor due to the changes make the cost of project increase directly. At the end of the project, the total expenditure is higher compare to the Bill of Quantity (BQ).

4.3.3 Argument between the client-consultant-contractor-supplier

Every party plays its role in completing the project. They are much related with each other. In simple words, they need and rely on each other very much. Good communication between them might be the strong element to strengthen the team. In the same time, poor communication might contribute a lot of problems. In this case, every party starts to pin point which and when will the delay happen. The main reason is that they do not

want to be responsible if the project fail to complete on time. Because of that, they will start to argue with each other. Indirectly the work progress is affected very much.

4.3.4 Payment problem

Contractor and sub-contractor really rely on the payment from the client to carry out their work. After completing a part of the work, they will submit the claim of payment to client. If delay occurred, some of them may not have work to be done. It is a problem because the contractor needs to pay their workers at the same time. Some of the contractors also go on strike until they get paid. For some cases, the client will cut the total claim from the contractor if they failed to fulfill their requirement. In my opinion, the client only creates the issues to cover back the budget due to the changes made by them, this problem occurred in Egypt after the revolution.

4.3.5 Work Re-planning

This project applies the Critical Path Method (CPM) to monitor well their work. Using CPM, it will assist them to arrange and prioritize their work. Some of the work cannot be carried out if the other work is not completed yet. This thing normally happens if the project is delayed. Project engineer and project manager need to review back the work plan and for sure several changes need to be done. The contractor is responsible to ensure the project is complete at the right time and several changes in the work plan looks like the best solution for them if the work is delayed.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.1Conclusion

In conclusion, this research has achieved the objectives stated in the early of the project which are:

1) There are 9 groups of factors that have been discussed. Each factor has its own contribution to the delay. But for both projects, the main contributor is the change of issues between the client, contractor, consultant and supplier.
2) The causes of delay have been ranked using the average index formula. It is worth noting that the causes of delay might differ in their ranking from one country to another according to the environment that the industry is faced with.
3) Based on the interview session, time and cost are very affected by the delay. The challenge is when the contractor and subcontractor need to overcome this problem but in the same time, they have problem with the payment from the client. Other than that, argument with different parties, payment problem and work re-planning really occur after the project is delayed.

5.2 Recommendations

To make this research more significant in the future, several aspects should be considered:

- Different cost of project should have different type of factors that contribute to the delay. Further research for each class of project should be more practical for industry

- Different types of projects might have different factors and effects, for example turnkey contract and conventional contract. So, research about this case study can be carried out in the future.

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Appendix

Questionnaires

Instructions

1. Answer ALL questions.
2. Fill (√) in the box available based on the legend stated.
3. All information will be treated as confidential. It will be used ONLY for academic purpose.
4. All information will be on aggregated basis and no individual data will be published.
5. For more information, please contact Mr Karim Medhat Makram at:
   Phone no: +6013-4135514/+201001436777
   Email address: karimmakram7@gmail.com

SECTION A: GENERAL INFORMATION

1. **Name** : .....
2. **Position** : .....
3. **Company's address** : .....
4. **Name of the project** : .....
5. **Type of the project** : .....
6. **Cost of the project** : .....
7. **Duration of the project** : .....

8. **Name of the client** : .....

9. **Number of staff involved** : .....

10. **Number of contractor involved** : .....
.....

11. **Number of consultant involved** : .....
.....

12. **Do this project face delay** : .....

13. **How do you measure the delay** : .....
.....

14. **Who is the most responsible party contribute to the delay** : .....
.....
.....

15. **What system do you used to control the work progress** : .....
.....
.....

16. **Is it efficient enough** : .....

17. **How often site meeting is conducted** : .....
.....

18. **Is it sufficient enough** : .....

SECTION B: FACTORS CONTRIBUTE TO THE DELAY

For each statement below, please tick (√) in the appropriate box to indicate whether it is:

1	Strongly disagree
2	Disagree
3	Moderately
4	Agree
5	Strongly agree

Work Environment	1	2	3	4	5
Hot weather					
Rain effect					
Insufficient available utilities					
Social and culture					

Project Financing	1	2	3	4	5
By main contractor					
Progress payment					
Partially payment					
Social and culture					

Manpower Allocation	1	2	3	4	5
Shortage of labor					
Labor skill					
Labor injuries					
Labor and management relationships					

Changes Issue	1	2	3	4	5
By owner/agent					
Design error					
Foundation condition					
Mistake in oil investigation					

Contractual Relationships	1	2	3	4	5
Conflict between contractor and consultant					
Difficulty of coordination					
Insufficient communication					
Poor contract management					

Equipment and Tool	1	2	3	4	5
Shortage in number					
Unskilled operators					
Lack of high-technology equipment					
Slow delivery					

Scheduling and Control	1	2	3	4	5
Preparation and approval of shop drawing					
Inspection and testing procedure					
Accident during construction					
Lack of work monitoring					

Materials Used	1	2	3	4	5
Shortage in number					
Materials changes in types & specification during construction					
Late delivery of materials					
Damage of materials					

Political Issues	1	2	3	4	5
Change in the upper hierarchy					
Workers on strike					
Turbulence in the area of construction					
The country is in a state of turmoil					

SECTION C: EFFECTS OF DELAY PROBLEM IN CONSTRUCTION

For each statement below, please tick (√) in the appropriate box to indicate whether it is:

1	Strongly disagree
2	Disagree
3	Moderately
4	Agree
5	Strongly agree

And please give your comments about each elements that affected by the delay problem.

	1	2	3	4	5
Work Environment					
Description					

	1	2	3	4	5
Project Financing					
Description					

	1	2	3	4	5
Manpower Allocation					
Description					

	1	2	3	4	5
Change of Issue					
Description					

	1	2	3	4
Contractual Relationships				
Description				

	1	2	3	4	5
Equipment and Tool					
Description					

	1	2	3	4	5
Scheduling and Control					
Description					

	1	2	3	4	5
Materials Used					
Description					

	1	2	3	4	5
Political Issues					
Description					