A STUDY OF PROJECT DELAY IN SUDAN

CONSTRUCTION INDUSTRY

By

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Specially dedicated to

My mom’s soul and my lovely Family

ABSTRACT

A STUDY OF PROJECT DELAY IN SUDAN CONSTRUCTION INDUSTRY

The construction industry in Sudan is an important sector due to its enormous contribution to the country's economic development. This in terms of employment opportunities and attraction of Foreign Direct Investments which grossly contributes to the country's GDP. However due to the geographical, political, social and financial situation of the country, many construction projects are prone to delay. These delay factors can only be avoided by first identifying the factors and their sources.

The main aim of this paper was to find out the main causes of delay in Building construction projects in Sudan. The research design was quantitative, where the data was collected from clients, consultants and contractors using questionnaires. The questionnaire had a list of delay causing factors of which the respondents were ask to rank each according to the 5 point likert scale. The data obtained were analyzed using the Statistical Program for Social Scientists (SPSS).

The results obtained indicate that the top major causes of delay were; fluctuation of prices of construction materials, shortage of materials, inaccurate time estimation, and errors during construction. In addition the top major effects of delay were; Cost overrun, acceleration of losses, time overrun, negative social

impacts and litigation. Also the top major risks associated with construction delay were; too much pressure on project stake holders, price inflation of materials and overall project, disputes amongst project participants, project abandonment, overall cost increase and decline in revenue. And finally the top major delay mitigating measures were; Information sharing, Total Quality Management (TQC), Quality cycles, Benchmarking, and Joint risk management.

Keywords: Construction delay, delay mitigation, risks, consultants, clients and contractors.

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APPROVAL SHEET

This thesis/dissertation entitled "**A STUDY OF PROJECT DELAY IN SUDAN CONSTRUCTION INDUSTRY**" was prepared by **MOHAMED BABIKIR IBRAHIEM MOHAMED** and submitted as partial fulfillment of the requirements for the degree of Master of **SCIENCE OF PROJECT MANAGEMENT /** Doctor of Philosophy in **PROJECT MANAGEMENT** at Universiti Tunku Abdul Rahman.

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(**MOHAMED BABIKIR IBRAHIEM MOHAMED**)

Date _____

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1.1 INTRODUCTION

Construction can be defined as an activity of the physical creation of infrastructure, superstructure and related facilities. It therefore comprises all civil engineering works and all types of building projects including; housing as well as maintenance and repair of existing structures (Wells, 1984).

Another definition states construction is a broad process or mechanism for the realization of human settlements and the creation of infrastructure that supports development. This includes the extraction and beneficiation of raw materials, the manufacturing of construction materials and components, and the construction of the project cycle from feasibility to deconstruction and the management and operation of the built environment (Plescis2002, p.4).

A broad definition of term stipulated that construction is that sector of an economy which through planning, design construction, maintenance, repairs and operation, transforms various resources into constructed facilities. The types of public facilities produced range from residential and non-residential to heavy constructions (Moavenzadeh, 1978).

Finally according to (Ofori, 1990) construction is that sector of an economy which plans, designs, constructs, alters, maintains and eventually demolishes buildings of all kinds of civil engineering works, mechanical work, electrical engineering structures and other

similar works. He further describes the construction industry as having different sectors producing heterogeneous products which are immobile, complex, durable and costly.

Construction delay can be referred to as a prolonged construction period beyond that which was estimated previously. These delays have been proven to be a potential source of risks in the construction industry such that many current studies are looking for ways it can be managed. The various risks associated with projects delay are cost related where delay will generally lead to an overall increase in the cost of the project.

Various studies carried out by (Cohen and Palmer, 2004, Baloi and Price, 2003, Milner and Lessard, 2001) have found sources of and categories of construction risks that needs to be managed as part of the project management process. Delays are at integral part of modern construction processes (Yates and Epstein, 2006). They stated that project delay starts from the inception phase of the project itself. In addition (Scott et al, 2004) mentioned that there is a tendency for construction projects to suffer from delays and such delays poses potential loses for all stake holders. These include client or owner through loss of use and increase cost and for contractor and consultant through prolong presence on the site and loss of confidence.

The biggest client of the construction industry in most countries is the government (OkpalaandAiekwu, 1988). A huge amount of their yearly budget is being allocated to carry out construction in the country such as roads, residential and non-residential buildings, hospitals and schools, to stimulate economic growth.

A clear case of example of government yearly allocation on construction is the Malaysian 2015 fiscal budget. It allocated RM50.5billion as development expenditure

involving road construction, schools, hospitals and other buildings (Star Magazine, 2014).

Delay is mostly common in the traditional type of contracts in which the contract is awarded to the lowest bidder. This procurement method is mostly practiced in developing countries. Ensuring that the project is delivered on time is one of the most significant needs of the clients in construction industry (Latham, 1994). Moreover completion of projects within the estimated time is an indicator of how efficient the construction industry is (Nedo, 1988). Quality, time and Cost are of primary concern to the contractor, but most often construction projects are procured based on only two factors; time and cost (Bennette and Grice, 1990).

1.1.1 Characteristics of Construction

The following are common features of construction; immobility, uniqueness, heaviness, bulkiness, complexity, long duration of process, high expenses and durability (Turin, 1980). It was also pointed by (Moavenzadeh, 1978) that construction is often characterized by immobility, custom built nature, high initial expenses, complexity, continuous changing technology. Thus the features of construction products and the broad range activities in the construction industry make construction worth of different consideration. The construction industry must satisfy the demand for housing, building constructions such as; social and commercial buildings, heavy engineering constructions and industrial constructions including factories (Palani, 2000).

1.1.2 The role of the construction industry in Sudan's development

Construction stimulates growth throughout the whole country and vanguards a country's development (World Bank, 1984). It contributes intensively to economic development by satisfying some of the basic objectives including support, generation, and employment creation, income generation and redistribution (Moavenzadeh, 1978). Construction is the only sector of an economy that is recorded twice. Firstly in the national account as a component of GDP (Gross Domestic Product) and Gross Domestic Capital. Secondly the International Labor Organization (ILO) reports construction employment as a separate entry in the Labor statistics report (Turin, 1980). A set of indicators were developed to observe the relationship between the construction industry and economic growth of a country (Turin, 1978), these indicators were

a) Value added in Construction as percentage (%) of GDP;

b) Value added in Construction per capita;

c) Employment in construction;

d) Value added in Construction per person employed;

e) Ratio of value added per person employed in construction to value added per person employed in manufacturing;

f) Ratio of value added in construction to value added in manufacturing;

g) Hourly Earnings in construction and manufacturing; and

h) Productivity in construction and manufacturing

He observed a positive correlation between per capita GDP and all the rest of the indicators except (f). This implies as GDP per capita is increasing, the above mentioned indicators are also increasing. On the other hand as the GDP is increasing, the ratio of value added in construction to the value added to manufacturing decreases.

He further made the following conclusions

a) The share of construction in the national product and the value added in construction per capita grow with economic development;

b) The ratio of net output in construction to net output in manufacturing and the share of infrastructure in total construction output decrease with economic development;

c) Value added per person employed in construction and employment in construction per thousand population grow with economic development, but with different rates of change; and

d) The gap between construction and manufacturing, in terms of net output per person employed and hourly earnings, tends to be close with economic development; in the developed countries net output per man tends to be the same in construction and manufacturing and hourly earnings are actually higher; but changes in productivity tend to be lower.

Table (1.1) shows a comparison between construction industry of developing and developed countries.

Table 1.1 comparison between construction industry of developing and developed countries

Economic Indictor	Developing Countries	Developed Countries
Value added by construction (as % of GDP)		
1955 -1965 (Turin, 1973)	3-5%	5-9%
1970-1980 (World Bank, 1984)	3-8%	7-8%
1960-1980 (Wells, 1985b)	3.6-5.2%	5.4-7.3%
Capital formation in construction (as % of GDP)		
1955 -1965 (Turin, 1973)	6-9%	10-15%
1960-1980 (Wells, 1985b)	8.9 -10.6%	13.5-13.6%
The Contribution of new construction assets (as % of GDFCF)		
1955 -1965 (Turin, 1973)	45-60%	
1970-1980 (World Bank, 1984)	50.8%	
1960-1980 (Wells, 1985b)	15.1-24.4%	24.6-24.1
1970-2006 (Giang & Pheng, 2011)	23%	26%
Employment in Construction (as % of total employment)		
1955 -1965 (Turin, 1973) & (Moavenzadeh, 1978)	2-6%	6-10%
1970-1980 (World Bank, 1984)	3.2	7.4%
1960-1980 (Wells, 1985b)	2.1-3.4%	6.6-8.1%
Employment by ancillary operations		
(Moavenzadeh, 1978)	2-4%	
Intermediate inputs from other sectors in the economy		
1955 -1965 (Turin, 1973)	50 - 60%	
Construction investment to civil engineering		
1955 -1965 (Turin, 1973)	30-55%	25-30%.

Source: (Alkram, 2011).

1.1.3 An overview of Sudan's construction industry

According to the World Bank, the construction industry of Sudan has been growing over the past decades. In 2006, it accounted for 40% of the country's GDP. This sector of the economy continues to drive the economic activities of the country with growth of 10% in2008. The sector is part of the revamping urban infrastructure estimated to cost some $7billion. A number of projects targeting businesses and foreign investors are coming to the country. This consists of multibillion dollar investments in retail outlets, offices, roads, airports, hospitals, schools and high class hotels.

The country continues to witness a dynamic activity as a result of infrastructure and rehabilitation and increased demand upon private and business property (Bank Audi, 2008). The industry is fragmented and diverse covering a wide spectrum of projects involving multitude activities. The construction projects range from mega projects such as dams, roads, airports, bridges and buildings to a single house construction.

Generally the industry suffers from lack of communication and coordination amongst the industry stake holders. This is due to the fact that the industry is highly fragmented, lacking a central body that brings the stake holders in the industry together. In addition, the industry has limited health, safety and equipment policies. They are cutting green areas in Khartoum and creating residential areas.

Most often the construction projects are procured either through competitive tendering especially for projects of public or business sectors or directly recruiting a professional to prepare a design that fulfill the needs of the client's need. In Sudan, the lowest bid tendering approach is the most common way of awarding contracts to contractors. This

approach open door for corruption and affects both quality and the time span of the project. It is often common that contractors guided by the intention to win contracts provide lower prices than actual prices of the projects.

1.1.4 Dealing with construction permits in Sudan

The regulation of construction is important to protect the public. Where complying with building regulations is excessively costly in times and money, many contractors will quit. They may bribe to bypass inspections or build illegally leading to hazardous construction that put the safety of the entire public at risk.

According to the data collected by Doing Business in 2014, to build a ware house in Sudan, dealing with construction permits requires 16 procedures and it takes 270 days and cost 248.8% of the country's per capita income.

Figure (1.1) below shows the time and cost needed to construct a warehouse in Sudan

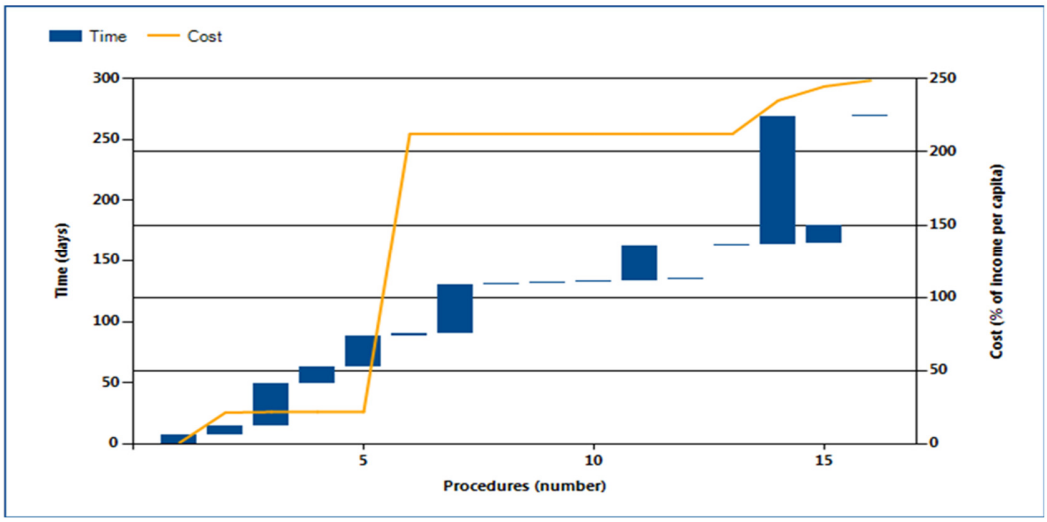


Figure 1.1 the time and cost needed to construct a warehouse in Sudan

Source: (Doing Business in Sudan, 2014)

It also states that Sudan stands at 167 positions in the ranking of 189 economies on the ease of dealing with construction permits. This ranking provides information for the contractor or a foreign company venturing to carry out a building construction work in Sudan. The estimated value to construct a ware house in Khartoum is SGD 420.000.

Table (1.2) shows a summary of procedures applied to obtain a building construction permit in Sudan including Cost and Time spent.

Table 1.2 a summary of procedures applied to obtain a building construction permit in Sudan.

No	Applied Procedure	Time	Cost
1	Getting a document of ownership of land from the land Authority	7 days	USD10
2	Getting planning permit from the Municipal Authority. The construction company must complete a form with respect to the location of the land and also show the urban planning department the sketches of the buildings.	7 days	USD800
3	Getting project clearance from the Department of Environment and Health	35 days	SDG22
4	Getting clearance from fire Department	14 days	No pay
5	Getting temporal construction permit from the local Municipal Authority. This is only possible after the department of environment and Health has approved the project clearance. Then the construction company can apply for the temporal construction permit to the local council.	25 days	No pay
6	Payment of money for the application of a construction permit (the issuance) at an authorized bank.	2 days	SGD9945
7	Getting approved and obtaining a construction permit. An application for a construction permit or any related structure needs be sent to the General Manager of the department of building at the Physical Planning and Urban utilities Ministry. The activities of construction are controlled by the state government of Khartoum Organization of the Construction Act 1997. The construction company must provide the following documents when applying for a construction permit; • Owner's full names and address • Documents indicating the number of plots and zone in		

	which the plot is found. • Document showing the class and area of the land • A drawing of the construction site as drafted by a personnel from the survey department in order to know the available area for the construction work. • A certificate from the department of Land Registry. This document must show if the land is freehold or lease hold. The engineering documents are also required as stipulated by the same act of 1997. The documents include the following; • Architectural drawings • Structural drawings • Floor plans and elevation • Direction of surface water drainage flow on property • Electrical drawings • Plumber drawings • Fire protection drawings.	40 days	No pay
8	Approval of foundation work inspection	1 day	No pay
9	Receive random inspection The constitution of the country states that building authorities have the right to visit the construction site to make sure that the building complies with given standards and drawings.	1 day	No pay
10	Requesting and Receiving last inspection The constitution also states that building authorities should be notified when the construction is completed in order to issue a certificate of conformity.	1 day	No pay
11	Getting a Certificate of Conformity Any construction, in which there was issuance of a construction permit, must be inspected for approval before covering any part or upon finishing any stage of the project. The owner has the responsibility to alert the department of Building that the project has been completed and to fix a date for inspection. If found after the inspection that the construction project was successfully completed according to the laws and standards, a Certificate of Conformity will be issued by the Department of Building.	30 days	No pay
12	Applying for water and sewage connection	1day	No pay
13	Getting water and sewage connection	1 day	No pay
14	Obtaining water and sewage connection	105 days	SGD1200
15	Requesting and receiving telephone connection after completion of construction	14 days	SGD 500
16	Land Registry updates	1 day	SGD 210

Source: (Doing Business in Sudan, 2014)

1.1.5 Problem Statement

Delay in construction projects has been a major issue in the Sudanese construction industry over the past decades. The government spends huge amount of money in the construction sector in an attempt to carry out economic development. It's a normal tradition to allocate developmental funds in her yearly budget. Majority of this fund is set aside for the construction of roads, railways, hospitals, schools, residential and nonresidential buildings and airports. If these projects are delayed, it will not only slow down economic growth in the country but it will also increase government expenditures. This will be due to procurement of materials at a higher price, and also due to change of contractors. The result will be wastage of country's resources that could have been used to for other purposes.

In addition, business organizations every year invest a lot of capital in construction of new facilities in an attempt to expand their businesses and generate more profits by increasing their sizes of operations and also to meet up with competition. When the problem of delay occurs, the companies turn to loss large amount of money that can sometimes render the company insolvent.

Moreover contractors are constantly loosing contracts due to delay or incompletion of previous projects. Most often they are obliged to share the cost of the delay which is not necessarily caused by them. Delay has also led to a lot of disputes amongst stake holders in the construction industry. If these disputes cannot be resolved amicably to the satisfaction of every party, some parties will prefer litigation and arbitration. All this will go a long way to increase the cost of the overall project.

Finally, delay will result to negative perception of the country's construction industry. Investors will not be willing to carry out construction projects in the country. In addition, predominance of delay will discredit the local construction companies, contractors, consultants and engineers. This will results to the country's construction industry be less competitive.

Therefore with all these problems faced by the government, business organizations, contractors, consultants, community and the construction industry as whole, it is therefore imperative that a study be conducted to ascertain the factors contributing or resulting to the delay of construction projects. With these factors clearly outlined, they can be considered as the critical success factors of the projects. With these already known, preemptive measures can then be taken to reduce, eliminate or mitigate their effects. Moreover a study on delay will help stakeholders to be able to pin point exactly where the delay is from or what causes the delay and which of the stake holder should be held responsible. With this the issue of disputes, litigation and arbitration can be avoided.

1.1.6 Aim

The main aim of this research paper is to find out the causes of delay in building construction projects in Sudan's construction industry.

1.1.7 Objectives

1. To find out the factors that causes construction projects delay

2. To investigate the effects of construction projects delay.

3. To determine the risks associated with construction projects delay

4. To identify the relevant ways of eliminating or mitigating the delays of construction.

1.1.8 Research Questions

1. What are the factors causing delay in construction?

2. What are the effects of construction projects delay?

3. What are the risks of construction delays?

4. How can delay in construction be mitigated?

5. Which stake holder is most likely to cause delay?

1.1.9 Research Significance

The findings from this paper will serve as a guide line to construction project holders of Sudan that is the government, business organizations, contractors, consultants and the community at large. They will be aware of the uncertain factors that can result to delay

of projects right from the inception phase. This study will also generate a list of delay causative factors that can be used as benchmark to control existing and future projects.

In addition stakeholders will also be aware of the delay related factors and how to avoid them. The study will also generate measures to mitigate or eliminate the effects of construction projects delay. Finally the study will also serve as a support of what other past researchers have written about factors causing delay in construction projects. It will also provide some information for future researchers who wish to further investigate on this particular or related case.

1.1.10 Research Scope

The research paper focuses only on the construction industry of Sudan. It concentrates specifically on the building constructions projects such as; schools, residential and nonresidential offices, hospitals. More attention will focus on projects where the main client is the government (public construction projects) and those owned by business organizations. Moreover we paid attention to construction projects in the urban part of the country such as Khartoum which is the capital city of Sudan. Finally we considered only mega construction projects that have all the stakeholders such as; contractors, subcontractors, and consultants. This is because if delay occurs, will be able to know if it was due to the government, owner, contractors, subcontractors or the consultants.

1.2 Chapters Outline

1.2.1 Chapter1

This chapter outlines the introduction, research questions, problem statement of the study, aim of research and specific objectives and finally the scope and limitation of study.

1.2.2 Chapter2

Comprise of the literature review, which brings out the main sources of the secondary data collection. A critical review of the causes of construction delays, effects of delay, risks associated with delay as well as measures to mitigate construction delays.

1.2.3 Chapter3

Describes the Methodology used to conduct the research. Precisely the respondents, the data collection tool (Questionnaire), the sampling techniques and the pilot study.

1.2.4 Chapter4

Discuss the data analysis and the result obtained from the study. This specifically includes statistical methods such as Cronbach Alpha, Kruska Wallis T-test, bar charts, pie charts and tables. Also contains specific discussion of each of the factors analyzed.

1.2.5 Chapter5

This section contains the general conclusion and recommendation of the research.

CHAPTER 2

2 LITERATURE REVIEW

2.1 INTRODUCTION

The process of construction can be divided into three distinct and significant phases; the project conception phase, project design phase and the project construction phase. As stated by (Chan and Kumaraswamy, 1997) a vast majority of project delay occur during the construction phase where many unforeseen circumstances and factors occur. Completing a construction projects within the estimated time and cost is an indicator of efficiency, but the process of construction is subjected to many unpredictable and changing factors which comes from different sources. These sources include performance of parties, resource availability, environmental conditions, and involvement of other parties and contractual relations, thus the completion of the project within the estimated time is rare (Asaf, 2006).

Delays are usually accompanied by cost overruns. When this occur, it will have a debilitating effect on contractors and consultants in terms of growth and adversarial relationship, mistrust, litigation, arbitration, cash flow problems and a general feeling of trepidation towards shareholders (Ahmed et al, 2002). In addition, delay of construction projects cause dissatisfaction to all parties involved and the main role of the project manager are to ensure that projects are completed within the estimated time and cost. Projects stakeholders need to develop the capacity to foresee potential problems likely to

affect their current and future projects. Identification of these common problems encountered on past projects in the construction industry is a good option to mitigate the factors that causes delay and their effects (Long et al, 2004).

However, construction project success can be defined as the completion of a project within the estimated time and cost. But it is rather unfortunate that projects successes are not common in the construction industry especially in the developing countries and third world countries. This could be due to inadequate expertise, finance, and environmental uncertainties and also inadequate supply of materials. From several studies and empirical evidence, it is clear that projects overruns comprises both delays and cost overruns occur during the construction phase. Therefore scholars, researchers and professionals have been motivated to take steps to meet these challenges.

Construction project delay is worldwide phenomenon (Sambasivan and Soon, 2007) that affects not only the construction industry but the overall economy of countries as well (Faradi and El-Sayegh, 2006). It often involves multiple complicated issues all of which are invariable critical to recover the cost of delay or the necessity to prolong the project with the consequential entitlement to recover the costs of adjusting to the contract schedules. When delay arises, there is always a question as to the causes of the delay and the opportunity of blames which most of the times will results to disputes and litigation (Bolton, 1990). Currently stake holders in the construction industry are increasing their concerns about the duration of the construction projects because of increasing interests, inflation, commercial pressures (Nkado, 1995) and of course it's potential to lead to disputes and claims leading to arbitration and litigation.

2.2 Classification of construction projects delays

Construction projects can be caused by many factors. (Ahmed, 2003) classified delay into two groups;

1. The internal causes which arises from within the project stakeholders (clients, contractors and consultants).

2. External factors which occur as a result of unforeseen factors. These factors arise not from the project participants. They can be termed act of God and may include the followings; weather conditions, natural disasters, government actions and material supplies.

Moreover construction delay was also classified into three categories by (Bolton, 1990). These include;

1. Excusable but non compensable. This is caused by circumstances not attributed to the project stakeholders or participants.

2. Compensable delay. This occurs as a result of acts or omissions of client or someone for whose acts the owner is liable to.

3. Inexcusable delays. This results from contractors' own fault or his subcontractors or materials. This may be sometimes due to lack of experience.

2.3 Construction delay

The construction industry is regarded as a complex, fragmented, scheduled and resource driven industry. A successful project is one that is completed on time, within budget and meets the specified quality standard that is satisfactory to the clients and all stakeholders involved (Chan and Kumaraswamy, 1993). A timely completion of the project is a criterion to ascertain project success.

2.4 Factors causing construction projects delays

Several academic researchers have carried out studies over the years to investigate the causes of construction projects delays. Amongst these studies were;

A study carried out by (Sweis et al, 2008) on the causes of delay of residential projects in Jordan found out that financial difficulties faced by contractors and too many changes made by the client were the leading causes of most delays. In another related research performed by (Abd El-Razak, 2008) in Egypt discovered that the most important causes of delay were financing by contractors during construction, delay in contractors' payment by owners, frequent design changes by owners or his agent during construction, partial payments and non-utilization of professional construction and contractual management. Furthermore a study was conducted by (Assaf and Alhajji, 2006) on time performance of different types of construction projects in Saudi Arabia, in an attempt to investigate the causes of construction delay and their importance according to each project participant (owner, consultant and contractor). A total of 73 delay related factors

were observed and the most common cause of delay identified by all three project participants was change on order.

In a similar report on the causes delay in large building projects in Saudi Arabia and their relative importance, (Assaf et al, 1995) reported a total of 56 possible causes were revealed; the contractors, the owners, engineers all ranked the financing group delay factors as the highest cause of delay. According to the contractors, the most important delay factors were preparation and approval of shop drawings, delay in contractors' progress payment by owners, and design changes. To the engineers and architects, the most important causes of delay were cash flow problems during construction, relationship between different subcontractors, schedules in the execution of the project and the slowness of owners' decision making process. On the other hand, the owners cited the main causes of construction projects delay to be design errors, excessive bureaucracy in project owner organization, labor shortages and lack of skillful personnel.

Moreover a study was conducted by (Ayman, 2000) in Jordan. He investigated the causes of delay of 130 public projects in Jordan. These projects were inclusive of residential buildings, offices, administrative buildings, medical centers and communication facilities. The results indicated that the main causes of delay of the public construction projects were related to designers, user changes, weather, site conditions, and late deliveries of materials, economic conditions and increase in quantity.

In Malaysia, a study of delay factors and their impacts on construction projects completion in the Malaysian construction industry was carried out by (Sambasvian and Soon, 2007). Their results showed a list of 28 different causes. Amongst these causes were; contractors improper planning, contractors poor site management, shortage of material, inadequate labor supply, equipment availability and failure, lack of communication amongst project participants and mistakes during the construction phase. Previous review also indicated that the factors that leads to delay in construction projects are many and differ from country to country and from circumstances to circumstances. (Oluguna et al, 1996) reported that there were distinct problems that caused delays in the construction industry of Nigeria. These factors were classified into 3 groups namely; firstly problems of shortages or inadequacies in industry infrastructure which are mostly supply of resources, secondly problems caused by clients and consultants and thirdly problems caused by contractors' incompetence or knowledge and experience deficiencies.

Also, a research was also conducted in Ghana by (Frank and Adwoa, 2007) to determine the factors causing delay of building construction projects in the Ghana construction industry. They carry out a survey using a semi structured interview of 15 key players in the construction industry of Ghana. A total of 32 delay related factors were determined. The most important factors were found out to be; delay in honoring certificates, underestimation of the project cost, underestimation of project complexity, difficulty in accessing bank credit, poor supervision, underestimation of completion time of projects by contractors, shortage of materials, poor professional management, fluctuation of prices, rising cost of materials and poor site management.

In addition (Kaming et al, 1997) cited that design changes, material changes, material shortages, and inadequate planning were the most important cost of delay in construction projects. A study also was conducted by (Ogulana et al, 1996) investigating the causes of delay of 12 tall buildings in Nigeria. They focused their studies on clients/consultants related, contractor related and external related causes of time delay. They observed that material shortages, over stretching of technical personnel and design changes were the most important causes of project delays.

2.4.1 CASE STUDY 1

KHARTOUM INTERNATIONAL AIRPORT (KNIA)

The construction of the KNIA in Khartoum project was awarded to Dorsch Consult Airport Holdings. The project was expected to be completed between the periods of 2003 to 2010 at a total cost of $1.8billion. The new Khartoum airport was constructed to replace the existing airport. It was designed to be a modern and strong infrastructural development that will benefit the country. The airport capacity was designed to serve over 6.5million travellers a year. Its construction was also supported by local construction companies.

However the KNIA construction has been delayed due to the high cost of construction of $1 billion as well as US sanctions on Sudan. In addition the country could not raise enough money due to division and loss of large oils fields especially at the boundaries affected the economy. At the end the project that was expected to be completed by

2014, but as a result of continuous delays due to inadequate finance, the completion period was shifted to 2014 (Lampret, 2013).

2.4.2 CASE STUDY 2

A common example of delay in construction projects caused by client and design changes occurred in Malaysia. This happened during the construction of the Kuala Lumpur International Airport (KLIA2) (Afig, 2013).

BinaPuri Holdings Bhd one of the main contractors of the project acknowledged that the delay was in the project was caused by indecisive move of the Malaysia Airport Holdings Bhd which was one of the clients with regard to the design of the terminal and facilities to be installed. In addition another stake holder Air Asia Bhd which was not part of the design stage of the projects also intercepted the project by requesting the inclusion of an automated baggage system which was not part of the original design. Air Asia in addition requested for more aircraft stands as well as longer runway for her jumbo jets to land. As a result of all these clients and design changes, the project was delayed by one year.

Even when the Kuala Lumpur International Airport was constructed more than a decade ago, it had originally planned for 3 months for Operations Readiness and Transition but it took six months. Other Airports that had faced similar problems of delay were Hong Kong Airport, Bangkok Suvarnabhumi and South Korea Incheon Airport.

Therefore delay is a very common issue in the construction industry and it's not limited to one country. It is common in developed countries as well as developing and under developed countries. The causes of delay in these countries are often similar.

2.5 Effects of Construction Project Delay

When construction projects are delayed, the effects are often injurious to the stakeholders. A research conducted in Nigeria by (Aibinu and Jaboro). They studied the effects of the delay in the construction industry of Nigeria. They discovered six possible common effects which arising in most countries as a result of delay. These effects were; cost overrun, time overrun, disputes, arbitration and litigation and total abandonment of project.

2.6 Cost Overrun

This refers to the excess of the actual cost that was planned or budgeted for the project from the conception phase to the construction and finishing phase. It can be referred to sometimes as cost escalation, cost increase or budget overrun (Singh, 2009). It can also be explained as the difference between the actual cost of the project and the initial cost budgeted

Researchers such as (Flyvberg et al, 2002) have shown that infrastructure projects often suffer from cost overruns. Cost overruns can sometimes be attributed to political factors

(Holm and Bubl, 2002). Politicians lie by either underestimating or exaggerating the benefits of projects to make it saleable and for their own interests

When construction projects are delayed, the specific and overall cost of the project will certainly increase. This is due to the fact that prices of materials in the market fluctuate over time. Thus the amount that was budgeted for materials may increase when delay occurs. In addition exchange rates will affect the prices of materials purchased from other countries, increase in price of labor. Moreover if the delay is as a result of changes in the design, the cost of the project will increase because the new design will be more expensive than the initial. And finally the change of government policies over time will also lead to cost increase of the projects particularly due to increase in tax rates.

However the above mention points will be true and feasible if the project is delayed for a period of one year and above.

The following cases of cost overruns projects expresses as a percentage to the overall cost was pointed out by (Singh, 2009). These include; the Suez Canal (1900%), Sydney Opera House (1400%), the Concorde Supersonic Aero plane (1100%), Bolton Big Dig (2750%) and the channel tunnel between UK and France (220%).

Another common example or case of cost overruns caused by delay is the construction of the Kuala Lumpur International Airport Terminal 2. The initial estimated or budgeted cost was RM1.7 billion. But due to delay of the project, the final cost of the project escalated to RM4 billion (Kini Biz online, 2004).

2.7 Time overrun

This is one of the most common issues in the construction industry. It can be defined as the failure to complete a project within the estimate time (Ahmed et al, 2012). It can be used as a tool for qualifying a project as failure. In Indonesia, (Kaming et al, 1997) carried out a survey to find out the main causes of time overruns in the construction industry. The most significant factors he mentioned were design changes, poor labor productivity, inadequate planning and resource shortages.

When the issue of time overrun occurs, the project completion time will be further extended beyond that which was estimated. The tendency is that it will lead to dissatisfaction by the owner or the clients. Sometime the contractor may lose the project as he will be seen as incompetent.

A study was carried out in Malaysia by (Aftab et al, 2011) on time overrun construction projects. They found out that a total of 30 construction projects were facing time overruns.

Table (2.1) shows some examples of projects carried out in Malaysia that faced time overrun.

Table 2.1 examples of projects carried out in Malaysia that faced time overrun

No.	Name of Project	Project Cost (Million RM)	Project Duration (days)	Time Overrun (Days)	% Time Overrun
	State of PERAK				
1	Construction of MRSM Kroh,	33.6	504	335	66.47
2	Construction of MRSM Kuala Kangsar, Perak	40.3	545	4	0.73
3	Enlarge/Upgrade of IKM Lumut, Perak.	11.2	700	35	5.00
4	Construction of KKTM Lenggong, Perak.	113.3	791	21	2.65
5	Fixing of Slipway Winh System, MIMET	1.3	265	68	25.66
	State of SELANGOR				

Source: (Aftab, 2011)

2.8 Arbitration and Litigation

Litigation is a court case that occurs amongst project stakeholders or participants in an attempt to settle an existing dispute. On the other hand, Arbitration occurs when in an attempt to settle a dispute amongst project participants, a third party known as an arbitrator is involved without going to the court. According to (Eipstein, 2005) these two phenomenon are inevitable and seem to be part of construction projects.

These phenomena often come into play when there is delay in the project and there is dispute as to the cause of the delay and who to assume the responsibility and claim charges. If anyone of the stakeholders is not satisfied, then he will be forced to file a suit against others. The overall effect is that it will further delay the project more and increase the cost including the cost of hiring an arbitrator or an Attorney.

2.9 Project Abandonment

Project abandonment can be referred to as putting a stop or an end to an ongoing project due to many difficulties and constraints or problems faced during the phases of the project life cycle such that it becomes impossible to continue at that time (Alusegun, 2011). Many construction and non-construction projects have been abandoned at various stages of their life cycle thus causing significant amount of loses to the stakeholders. To the owner or client loses in terms of capital and other resources including time. To the contractors and consultants loses in terms of time and wastage of expertise. Usually most projects abandoned as a result of too much prolonged delay. The contractors, consultants or owner can abandon the projects.

In Nigeria (Kotangora, 1993) reported that there were about 4000 uncompleted or abandoned projects belonging to the Nigerian government with an estimated value of 300billion Naira. In addition (Yap, 2013) stated that in 2000, there were about 54 abandoned housing projects in the country with an estimated value of RM7.5billion.

Project abandonment often results from inadequate planning, inadequate finance, inflation, delayed payments political factors, incompetent management, wrong estimates, design and inadequate cost control and above all dispute amongst stake holders.

2.9.1 Construction Project Risks

Construction risks can be defined as those factors that pose as threats and problems to the overall project completion and hinders or impairs the achievement of the projects'

objectives (Mark et al, 2004) that is having significant negative impacts on the scope, costs, schedule and quality of the project. Risks can be clearly distinguished from uncertainty in that uncertainty cannot be quantified, whereas risks can be quantified (Hilson, 2004).

The potential sources of construction projects risk could include unforeseen circumstances and problems related to the construction company's' changing profit margin, competitive bidding process, weather conditions, job site productivity, political situations, inflation, contractual rights and market conditions (Karimiazari et al, 2011). Construction risks can also be classified in numerous ways by types (nature and severity), the origin or source as well as the project phase (Cooper and Champman, 1987)

The table (2.2) below adapted from (Pejman, 2012) shows a variety of risks, risks events and risks conditions.

Table 2.2 a variety of risks

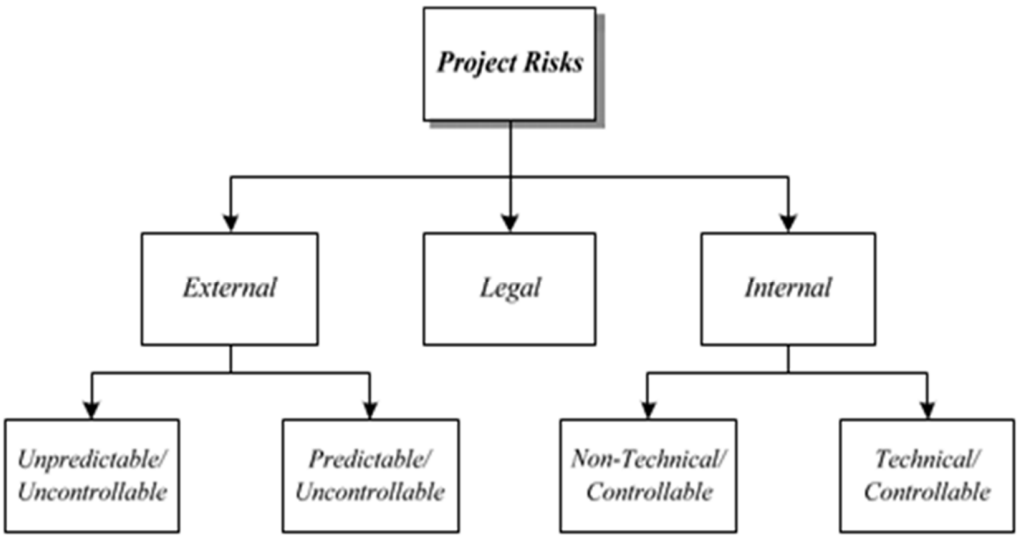
Risk Events	Risk Conditions
Imperfect start of integrated Project Management in relation to the life cycle of the project.	Insufficient planning, integration or allocation of resources. Insufficient or no post project review.
Inaction or wrong action due to incorrect information or communication.	Carelessness in communicating. Wrong handling of complexity. Lack of enough consultation with project's publics "both internal and external
Strikes, terminations, organizational	Conflicts poorly managed.

Breakdown as well as resignation	Poor organization, definition or allocation of responsibility, or lack motivation. Poor use of accountability. Lack of leadership, or vacillating management. Consequences of ignoring or avoiding risk.
Contractor insolvency. Claims settlement or litigation.	Unenforceable conditions. Incompetent or financially deficient workers/contractors. Adversarial relations. Inappropriate or unclear contractual assignment of risk.
Impacts of accidents, fire, theft. Unpredictable price changes	Errors in calculation, including estimating uncertain conditions. Inadequate investigation of unforeseen circumstances Low productivity, cost or change control. Poor maintenance, security, purchasing,
Specific delays, such as strikes, labor or material availability, extreme weather, work rejection	Poor attitude to quality. Low standard design/materials/workmanship. Insufficient quality assurance program.
Changes in the work scope to meet the specific objectives of the project.	Insufficient planning or planning lead time. Poor definition of scope breakdown, or work packages. Inconsistent, incomplete or unclear definition of quality requirements. Inadequate scope control during implementation.

2.9.2 Risks Break Down

In general, risks associated with construction can be grouped based on their origin and impacts on the objectives of the construction projects. These can be external, internal and legal. This is represented on the diagram below.

Diagram 2.1 risks break down



Source: (Pejman, 2012).

According to the breakdown of risks sources, construction project risks classified as internal, that is risk arising from within the project itself, or external that is risks arising from outside the project (Radujkovic, 1996). External sources could include; legislative, political, economic, social as well as natural. Meanwhile internal sources could be; contract, technological, organizational, resources, and human factors. All this factors can be represented on the table below

2.9.3 Breakdown of risks sources

Table 2.3 breakdown of risks sources

EXTERNAL SOURCES –outside the project		INTERNAL SOURCES – inside the project	
LEGISLATIVE	1 - local regulations	**CONTRACT**	1 – unrealistic deadline
	2 – permits and agreements		2 - unrealistic price
	3 – law changes		3 – other contract provisions
	4 – standards	**TECH. DOCUM.**	1 – delay
POLITICAL	1 – policy changes		2 – incompleteness
	2 – elections		3 – imprecision
	3 – war		4 .- new solutions as a consequence of 2 and 3
	4 – existing agreements	**ORGANIZATION**	1 – bad management
ECONOMICAL	1 – economic regulations		2 – bad organization of works
	2 – price rises	**TECHNOLOGY**	1 – poorly chosen tech. solutions
	3 – exchange rates		2 – obsolete technology
	4 – financing conditions	**RESOURCES**	1 – shortage of workers
	5 – economic policy changes		2 – shortage of machinery
SOCIAL	1 – education, culture		3 – machinery breakdowns
	2 – seasonal work		4 – late delivery of materials
	3 – strike	**HUMAN FACTOR**	1 – productivity
	4 – human fluctuation		2 – sick leaves
NATURAL	1 – climate		3 – motivation
	2 – soil		4 - errors and omissions
	3 – subterranean waters		
	4 – natural disasters		

Source: (Radjukovic, 1996).

2.10 Mitigating Construction Delays

As earlier mentioned above, a construction project is commonly classified as successful when the objectives of the project are attained that is the project is efficiently and effectively completed within the specified time and budget without compromising quality. Mitigation or elimination of construction projects delays implies minimizing or

eradicating those unfavorable or negative factors that can hinder or pose as threats which will interfere with the project completion within the allocated time and budget and quality as well.

Researchers such as (Abdelnaser, 2005) cited that implementation of adequate planning during the inception and design phases of the project can be a strong measure of avoiding delay during the construction phase. In another survey was conducted by (Nguyen, 2004) in an attempt to establish measures to minimize delay in large construction project in Vietnam. He recommended five important measures were; availability of sufficient resources, multidisciplinary or competent project team, competent project managers, accurate first cost estimates and accurate initial time estimates.

In addition, (Aibinu and Jagboro, 2002), found out two major ways of avoiding construction delays (time overrun) to be acceleration of site activities and contingency allowances. The enforcement of liquidated damages and offering of incentives for early completion were also strong measures suggested by (Odeh and Battaineh, 2002) to improve construction project situations. (Koushki et al, 2005) also carried out a study for the time delay and cost overrun minimization. They pointed out the following measures, sufficient and readily available financial resources until completion of the project, selecting highly skilled consultant and reliable and competent contractors to carry out the project.

Other measures of mitigating construction delay identified from the literature are represented on **the table (2.4)** below.

Table 2.4 measures of mitigating construction delay

NO	Methods of Avoiding or Minimizing Delays
1	Accurate initial cost estimates
2	Adopting a new approach to contract award procedure by giving less weight Prices and more weight to the capabilities and past performance of contractors
3	Perform a preconstruction planning of project tasks and resource needs
4	Selection of a competent consultant and are liable contractor to carry out the work
5	Allocation of sufficient time and money at the design phase
6	Resource Availability
7	Commitment to projects
8	Competent project manager
9	Comprehensive contract documentation
10	Ensure adequate and available source of finance until project completion
11	Frequent progress meeting
12	Enforcing liquidated damage clauses
13	Offering incentives for early completion
14	Hire an independent supervising engineer to monitor the progress of the work
15	Multidisciplinary/competent project team
16	Make use of current technology
17	Absence or less bureaucracy
18	Accurate initial time estimates
19	Adopting new approaches to contracting such as Design-Build (D/B)
20	Construction management (CM) type of contracts
21	Awarding bids to the right/experience consultant and contractor
22	Clear information and communication channels
23	Developing professional and skillful of human resources in the construction industry through proper training and classifying of craftsman
24	Effective strategic planning
25	Ensure timely delivery of materials
26	Proper emphasis on past experience
27	Community involvement

28	Systematic control mechanism
29	Acceleration of site activities
30	Contingency allowance.

2.11 Conclusion

Delays in construction projects cannot be 100% avoided or eliminated. However appropriate measures if put in place can reduce or eliminate some factors that cause construction delays. From the literature, it is observed that some of the causes of construction delays are inadequate materials, rising costs, incompetent contractor, shortage of workers. Most of the delays factors were due to the contractor and clients. The effects of construction delays were cost overrun time overrun and project abandonment. The risks of construction delays were low productivity, inflation, cost and time overrun. Delays could be avoided by timely delivery of materials, contingency allowance, community involvement, less bureaucracy and use of current technology.

CHAPTER 3

3 RESEARCH METHODOLOGY

3.1.1 Introduction

This chapter comprises of the method and the design that was used to conduct the research. It was a quantitative research in which the data was collected using questionnaires. The population was made of clients, contractors and consultants who were selected by random sampling and convenience sampling technique. There was collection of both primary and secondary data. The primary data was obtained using questionnaires while the secondary data was gathered from the literature. In addition this chapter also presents the questionnaire design, the different sections of the questionnaires, the scale as well as the pilot study that was conducted to ascertain the reliability of the questionnaire.

The research methodology chosen for this study comprised of intensive literature review, mail questionnaire to building construction stake holders in Sudan and a statistical analysis of the Survey.

- Literature gathering
- Literature review
- Identification of delay factors, effects, risks associated with delays and mitigation measures.
- Questionnaire preparation

- Questionnaire Survey
- Data collection
- Data analysis

3.2 Research Design

The research was designed to get opinions from clients, consultants and contractors of construction companies in regards to the factors causing delays, effects of delays, as well risks associated with construction delays. The possible causes, effects and risks of delays were identified from the literature and these factors were tested with the stakeholders of the Sudanese construction industry.

A total of 30 delay factors were identified from the literature and stake holders of the Sudan construction industry were asked to give their opinion on these causes in the form of ranking.

Also 11 effects of construction projects delay were also identified from the literature and questions were designed according to these factors to get the opinion from stake holders of Sudanese construction industry. Similarly, risks factors associated with construction projects delays were also identified.

3.3 Population and Population size

The population was made of consultants, contractors with over 10years of experience in the construction industry and private clients or owners. Moreover all respondents had

attained tertiary education. This implied the high position, lengthy years of work experience and educational background provided our respondents with enough knowledge of the construction industry with issues relating to causes, effects and risks of construction delay.

The population size consisted of 50 respondents, which included 20 contractors, 15 consultants, and 15 clients. The population size was limited to this number to effectively maximize the time and cost allocated for the research since the questionnaires had many questions and will be time consuming which might discourage some respondents from participating. Also the wide nature of the questionnaire may not be within the competence of some construction stakeholders. However effective selection of the target respondents with high competence and experience proved to shield these weaknesses.

3.4 Sampling Techniques

In this study, we used two sampling techniques because of the quantitative nature of the research. We obtained a list of consultants and contractors with their head offices in Khartoum from websites. A random sampling method was then used to select the contractors and consultants. Random sampling is defined as the probability of choosing people or things in a random manner, without any criteria with the aim of eliminating bias (Komb and Tromp, 2006). A total of 35 construction companies were selected from the list of local and foreign registered companies based in Khartoum from where 15 consultants and 20 contractors were randomly selected.

The private clients or owners were selected using the convenience or the snow ball sampling technique. Snow ball sampling is a non-probability technique where elements are selected based on the researcher's convenience that is from friends, colleagues, professional contacts or referral networks. This method is highly recommended in a situation where there is difficult to obtain data from random sampling.

3.4.1 Data Collection

This is referred to as the gathering or the collection of information from customized target respondents to suitably answer the research questions or the research objectives or give answers to findings. In this study, the data was obtained using 2 different methods.

3.4.2 Primary data collection

The primary data refers the first hand information obtained by the researcher himself in his or her study. This information is made available for the first time only by the researcher. The information can be collected through direct personal investigations, through respondents, and survey using questionnaires. The collection modes could also be through; emails, personal interview, phone interview and self-administered survey. The advantages of this method of data collection include; reliability and accuracy and moreover it is a better method for intensive investigation. On the other hand, the disadvantages will be high cost and too much time spent, and the method is not suitable for extensive enquiry.

Because of the quantitative nature of our study, the primary data was collected in the survey by making use of questionnaires and also telephone interviews. The questionnaires were emailed to our target respondents who were expected to fill the soft copy of the questionnaires and returned them by emails.

3.4.3 Secondary data collection

The secondary data refers to that information which have already been collected, analyzed, documented and published by some other researchers or people. The researcher therefore uses this information to support his or her current study or findings. Obtaining this information is faster, less expensive, and vigorous activities such as surveys are not required. However, this information collected is not always available for free and will cost money, the information are not always enough, some are old or expired meanwhile some are false information.

In this study, our secondary data was collected from academic online websites such as Emerald, online journals, School libraries and both published and unpublished articles.

3.5 Questionnaires

In order to determine the perception of different stake holders in Sudan construction industry regarding factors causing delays, a questionnaire was developed. This was the main tool used to collect the data from our target respondents. The questionnaire was structured into 5 sections to meet all 4 research objectives.

Section A had questions to determine the respondents' background.

Section B was to design to get the opinions of construction stake holders regarding causes of construction delay.

Section C questions were design to ascertain the effects of delay.

Section D questions were to bring out risks associated with construction delays.

Section was design to determine the measures to mitigate risks of construction delays.

Before the questionnaires were emailed to our respondents in Sudan, a pilot study was conducted in Malaysia to test the validity of the questions and if they will be suitable to meet the research objectives. We distributed the questionnaires to some contractors and consultants working in Malaysia.

The questionnaire had a total of 64 questions. 30 questions were related to the causes of construction delays, 11 questions were related to the effects and the rest of the questions were related to risks associated with delays and measures of mitigating the risks.

For the factors causing delays and the effects of delay, the questions were design based on the 5 point Likert Scale which measures from 1-5 according to the level of contribution and impact of each factor.

Strongly Agree (5)

Agree (4)

Moderate (3)

Disagree (2)

Strongly Disagree (1)

For questions relating to mitigating risks due to construction delays, a total measures were identified from the literature and the questionnaires were design using the 5 point Likert scale to determine the effectiveness of each of these measures.

Very highly effective (5)

Highly effective (4)

Effective (3)

Lowly effective (2)

Very lowly effective (1)

3.6 Pilot Study

A pilot study involves testing a questionnaire with a small group of people who represents target respondents. This will help pin point mistakes in the questionnaire and will also determine if the questions will be understood and easily answered by the respondents.

A pilot study was conducted in Malaysia. We had the opportunity to meet some contractors and consultants around Petaling Jaya, who took some time to study the questionnaires and gave some feedback. The feedbacks obtained were as followed;

- The questionnaires must have cover page

- The sections in the questionnaires should contain general information about the respondents.
- Some questions needed to be modified including more details
- Some questions were repeated having the same meaning
- Use simple words to ease understanding of the questions.

The feedbacks back were then noted and the questionnaires modified and adjusted accordingly. A total of 50 questionnaires were prepared and sent via emails to consultants, contractors and private clients in Sudan. Telephone interviews were also conducted with some contractors and consultants to get their opinions on mitigating construction risks associated with delays. Out of the 50 questionnaires, 15 were sent to contractors, 15 to consultants and 20 private clients. All questionnaires were returned via emails after 3 weeks. The results were then obtained and analyzed using statistical tools.

3.7 Conclusion

Based on the study design, the questionnaires were sent to the respondents only through emails and there was no physical contact with them. Follow up was done via phone calls to constantly remind them on the importance to participate in the survey and also crucial nature of the time line to resend the questionnaires. Only questionnaires that were fully completed were accepted. Those partially filled were not considered for the analysis.

However the numbers of questionnaires successfully completed were enough to produce valid and justifiable results.

CHAPTER 4

4 DATA ANALYSIS AND RESULTS

4.1.1 Introduction

This chapter presents a series of statistical tests and analysis carried out for the factors of each of the sections. These include the causes of delay, effects of delay, the risks of delay as well as ways of mitigating delays. It also presents the results of the questionnaires which were carried out using the SPSS. The results were represented using tables and descriptive statistics such as the bar charts, pie charts, and the mean. The Cronbach Alpha test that's shows the validity of the questionnaire used is also presented in this chapter.

4.2 Cronbach Alpha Test

Before the results obtained from the questionnaires received were being analyzed, a Cronbach analysis was carry out to ascertain the reliability of the questions. This is a test of reliability that that measures the internal consistency of the questions using the Likert scale. That is the questions were correlated to each other as a group. This reliability test was conducted for the four different sections as indicated on the research objectives. The results were represented on the table below.

Table (4.1) shows the Cronbach's Alpha reliability test

Table 4.1 the Cronbach's Alpha reliability test

SECTIONS	Cronbach's Alpha	Number of Questions
B	0.996	30
C	0.981	11
D	0.978	10
E	0.989	13

The results from the Cronbach analysis indicate that all the items for the sections are correlated. There is internal consistency and the items functions as group for each section. This is because the Cronbach Alpha coefficient for each group of questions is high and close to 1. For Section B 0.996, section C 0.981, section D 0.978 and section E 0.989. Therefore we concluded that our test and questions were reliable.

4.3 Demography

4.3.1 Participants job positions.

Table shows the job distribution of the participants that took part in the survey.

Table 4.2 the job distribution of the participants

Job profile		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Consultant	14	28.0	31.1	31.1
	Contractor	13	26.0	28.9	60.0

	Client	18	36.0	40.0	100.0
	Total	45	90.0	100.0	
Missing	System	5	10.0		
Total		50	100.0		

Figure (4.1) shows a pie chart of the participants' job profile

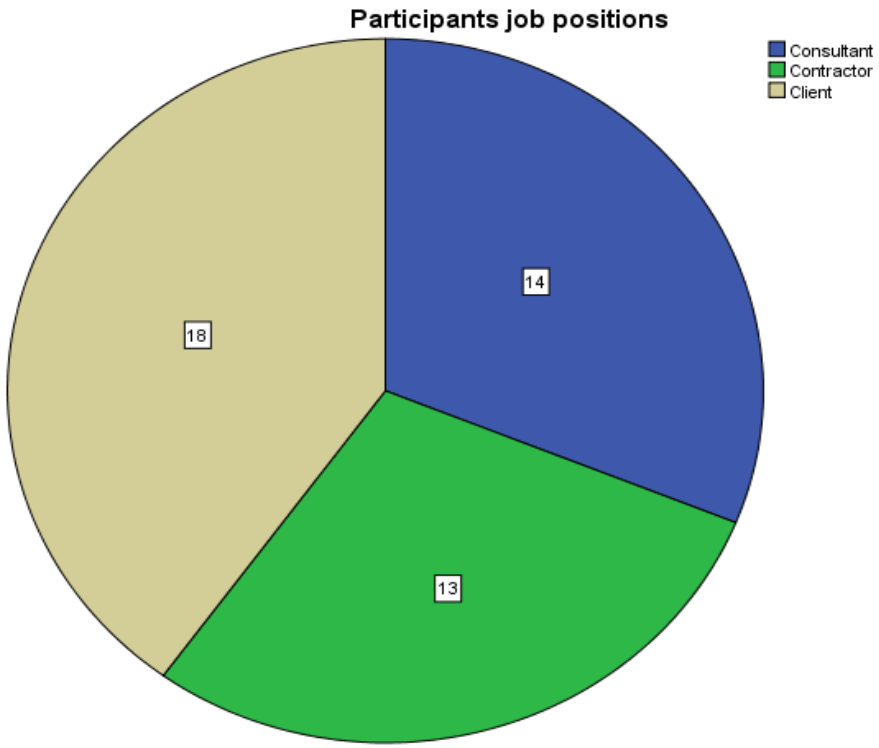


Figure 4.1 participants job positions

The results indicate that out of 50 questionnaires that were distributed, 45 were successfully completed and returned. Of the 45 questionnaires returned, 18 (36%) were answered by Clients, 14 (28%) were responded to by Consultants and 13 (26%) were answered by Contractors.

Table (4.3) shows the participants' years of experience:

Table 4.3 Participants years of experience

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	5-10	13	26.0	28.9	28.9
	11-15	10	20.0	22.2	51.1
	16-20	9	18.0	20.0	71.1
	21-25	7	14.0	15.6	86.7
	26-above	6	12.0	13.3	100.0
	Total	45	90.0	100.0	
Missing	System	5	10.0		
Total		50	100.0		

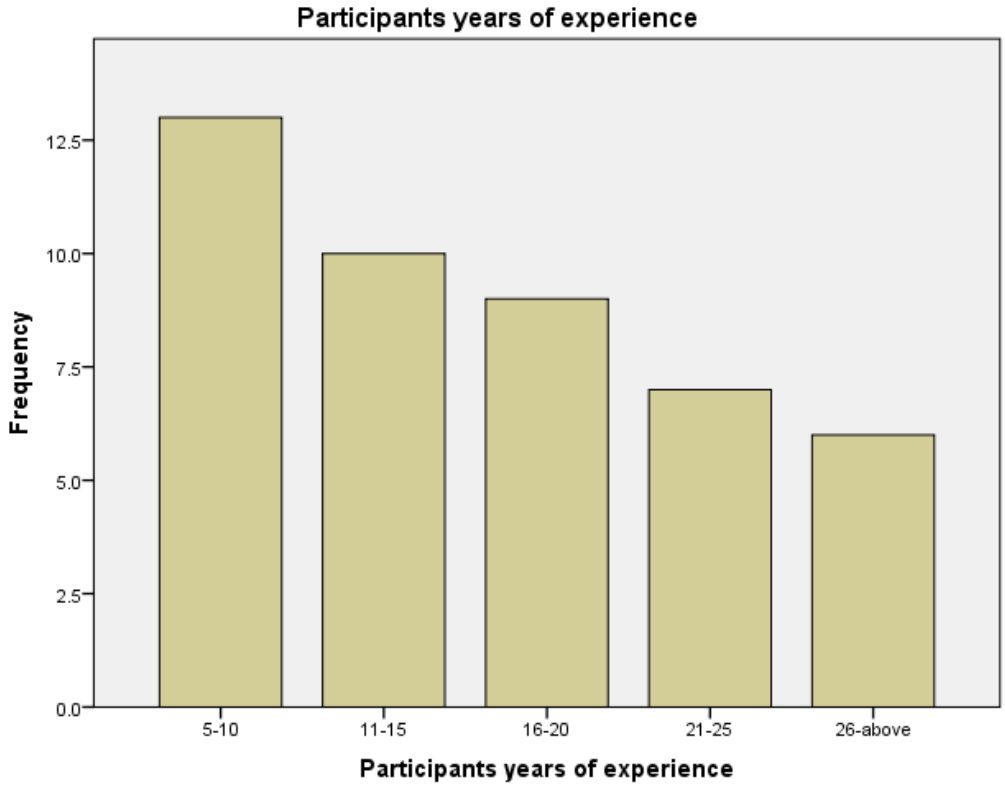


Figure 4.2 participants years of experience

The results above clearly show that out the 45 returned questionnaires, 13 (26%) of the respondents had 5-10 years of working experience, 10 (20%) respondents had 11-15 years of working experience, 9 (18%) had 16-20 years of working experience, 7 (14%) had 21-25 years of working experience and finally 6 (12%) had 21 and above years of working experience. Majority of our participants for the survey were very experienced professionals in the construction industry. This shows that the results we will obtain will be valid.

4.4 Factors causing Construction delay.

To analyze the results of the factors causing delay, SPSS was used to calculate the mean of distribution of each factor. The factors were then ranked based on the frequency of response by the respondents. The factors that scored the highest mean were ranked top factors that cause delay in the building construction. This is represented on the table below.

Of the 30 factors that were analyzed for the causes of construction delays, it was observed that 14 of the factors causing delay were contractor related 8 of the factors were caused by consultants, while 8 factors were also caused by Clients.

This was summarized as follows on **the table (4.4)** below.

Table 4.4 summarize of the 30 factors

Clients	**Consultants**	**Contractors**
Fluctuation of prices	Inaccurate time estimation	Errors during construction
Shortage of materials	Improper planning	Old technology
Delays in payment to contractors	Design changes	Late delivery of material
Compensation issues	Inaccurate cost estimation	Incompetent contractors
Funding problems	Project schedule changes	Inadequate contractor's experience
Late delivery of material	Supply / procurement problems	Incompetent project team
Contractual claims	Poor understanding of the project	Accidents during construction
Government interference	Acts of God	Multiple projects by contractors
		Inappropriate construction methods
		Conflicts among the involved

		parties
		Rework due to errors
		Delays caused by subcontractors
		Poor site management
		Skills shortage / unavailability

4.4.1 Kruskal Wallis H Test.

The Kruska Wallis test was carried using SPSS to determine if there are significant differences between the delay factors caused by clients, contractors and consultants. The results were reported as shown on the table below.

Table 4.5 Kruskal Wallis H Test

Ranks

	Project participants	N	Mean Rank
delay factors	Clients	8	8.50
	Consultants	8	8.50
	Contractors	14	23.50
	Total	30	

Table 4.6 test Staistics

Test Statistics[a,b]

	delay factors
Chi-Square	29.000
df	2
Asymp. Sig.	.0014

a. Kruskal Wallis Test

b. Grouping Variable:

Project participants

The results of the Kruska Wallis H test indicate that there was a statistical significant difference in the delay factors between the different groups of the project participants, $x^2 (2) = 29.000, p = 0.014,$ with the mean rank for each project stakeholder group being Clients (8.50), Consultants (8.50) and Contractors (23.50).

Table (4.7) shows the Mean Score Value (MSV) and Ranking.

Table 4.7 the Mean Score Value and Ranking

Descriptive Statistics			
Delay Factors	N	Mean Score	Rank
Fluctuation of prices	45	4.0000	1
Shortage of materials	45	3.6667	2
Inaccurate time estimation	45	3.6444	3
Errors during construction	45	3.5556	4
Improper planning	45	3.56	5
Delays in payment to contractors	45	3.4667	6
Shortage of materials	45	3.4444	7
Compensation issues	45	3.4222	8
Design changes	45	3.4000	9
Inaccurate cost estimation	45	3.4000	9
Funding problems	45	3.3778	10
Old technology	45	3.3111	11
Late delivery of material	45	3.3111	11
Skills shortage / unavailability	45	3.2889	12

Contractual claims	45	3.2889	12
Project schedule changes	45	3.2444	13
Incompetent contractors	45	3.2222	14
Inadequate contractor's experience	45	3.2222	14
Incompetent project team	45	3.2222	14
Accidents during construction	45	3.2000	15
Multiple projects by contractors	45	3.2000	15
Inappropriate construction methods	45	3.18	16
Conflicts among the involved parties	45	3.1333	17
Government interference	45	3.1333	17
Poor site management	45	3.02	18
Acts of God	45	3.0000	19
Delays caused by subcontractor	45	2.98	20
Supply / procurement problems	45	2.8889	21
Poor understanding of the project	45	2.8889	21
Rework due to errors	45	2.8222	22

4.4.2 Causes of Construction delay due to Clients

The table below shows the different factors causing construction delay. The factors were ranked according to their mean scores from highest to smallest. The factor with the highest mean score is the most common delay factor caused by clients.

Table 4.8 the Mean Score Value and Ranking

Clients	Mean score	Rank
Fluctuation of prices	4.0000	1
Shortage of materials	3.6667	2
Delays in payment to contractors	3.4667	3
Compensation issues	3.4222	4

Funding problems	3.3778	5
Late delivery of material	3.3111	6
Contractual claims	3.2889	7
Government interference	3.1333	8

4.4.3 Causes of construction delay due to Consultants

Table 4.9 the Mean Score Value and Ranking

Consultants	Mean score	Rank
Inaccurate time estimation	3.6444	1
Improper planning	3.5600	2
Design changes	3.4000	3
Inaccurate cost estimation	3.4000	3
Project schedule changes	3.2444	4
Acts of God	3.0000	5
Supply / procurement problems	2.8889	6
Poor understanding of the project	2.8889	6

4.4.4 Construction delay caused by Contractors

Table 4.10 the Mean Score Value and Ranking

Contractors	Mean score	Rank
Errors during construction	3.5556	1
Old technology	3.3111	2
Late delivery of material	3.3111	2
Skills shortage / unavailability	3.2889	3
Incompetent contractors	3.2222	4
Inadequate contractor's experience	3.2222	4
Incompetent project team	3.2222	4
Accidents during construction	3.2000	5
Multiple projects by contractors	3.2000	5
Inappropriate construction methods	3.1800	6
Conflicts among the involved parties	3.1333	7
Poor site management	3.0200	8

Delays caused by subcontractors	2.9800	9
Rework due to errors.	2.8222	10

Figure (4.3) below also shows a bar chat of the delay causing factors and their respective means in descending order.

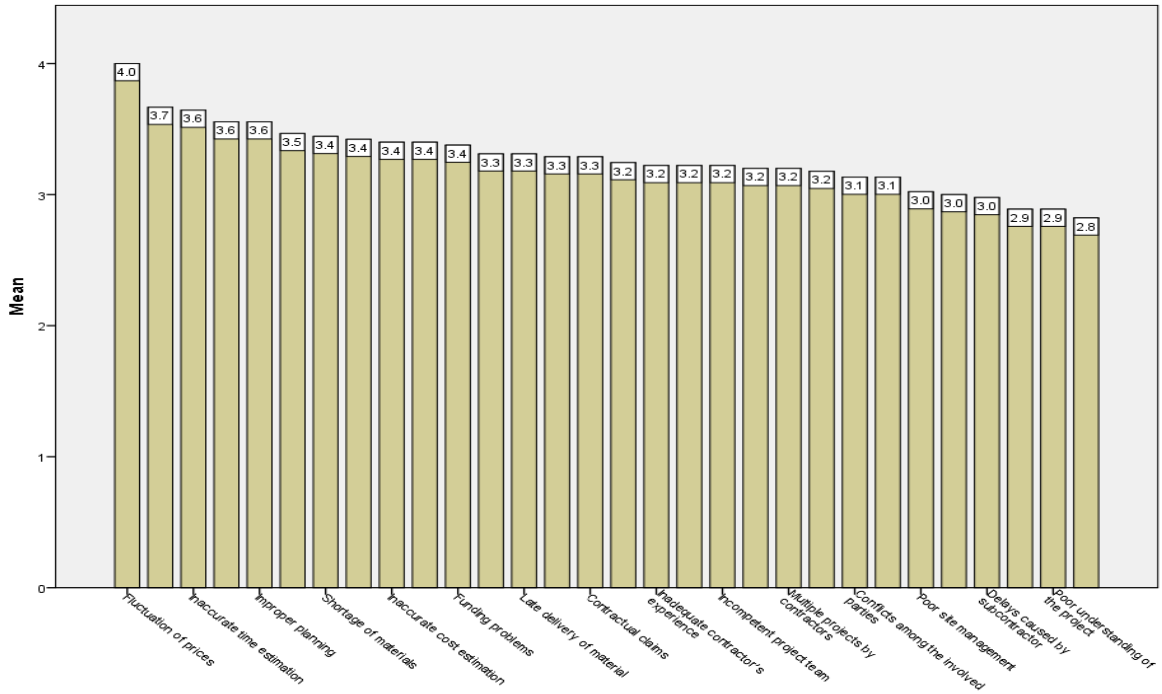


Figure 4.3 bar chat of the delay causing factors

4.4.5 The Average Mean Ranking

SPSS was used to compute the mean ranking for each factor. This implies adding the scores for each delay factor and dividing it by the highest scale which is 5.The result was represented on a **table (4.11)** as shown below.

Table 4.11 the Average Mean Ranking

Delay Factors	Average
Fluctuation of prices	1.00
Shortage of materials	1.00
Inaccurate time estimation	1.00
Errors during construction	1.25
Improper planning	1.25
Delays in payment to contractors	1.75
Shortage of materials	1.75
Compensation issues	2.00
Design changes	2.00
Inaccurate cost estimation	2.00
Funding problems	2.25
Old technology	2.25
Late delivery of material	2.25
Skills shortage / unavailability	2.75
Contractual claims	2.75
Project schedule changes	3.00
Incompetent contractors	3.25
Inadequate contractor's experience	3.25

Incompetent project team	3.25
Accidents during construction	3.25
Multiple projects by contractors	3.25
Inappropriate construction methods	3.25
Conflicts among the involved parties	3.25
Government interference	3.25
Poor site management	3.30
Acts of God	3.50
Delays caused by subcontractor	3.70
Supply / procurement problems	4.30
Poor understanding of the project	4.50
Rework due to errors	4.50

4.4.6 Discussion

1. Fluctuation of prices

   The constant changes of prices of construction materials in the market are a major cause of delay. If the prices of materials increase it will affect the budget estimated to complete the project. Thus if the company is not able to raise more money, the project is bound to be delayed.

2. Shortage of construction materials.

If the materials needed to carry out the project to construction are limited, it will cause the project to be delayed.

3. Inaccurate time estimation.

   This refers to the amount of time allocated to complete the project. This usually arises as a result of improper planning. If the project timing is underestimated then obviously it will be delayed.

4. Errors during construction.

   Most often the employees in the projects are inexperienced and lack some skillful expertise. This gives room for too much construction errors to be committed. When these errors occur, the job ought to be repeated and this will cause the project to be delayed.

5. Improper planning.

   When the project participants failed to plan for the project accurately, it will affect the project's completion time and hence delay will occur.

6. Delay in Contractor' payment.

   Monetary rewards will results to motivation of the contractor and his team. When payments are delayed even materials to be purchased by the contractor will be delayed. Also paying his employees will also be a major problem. Some can even abandon their jobs. All these will delay the project.

7. Compensation issues

   If problem arises during compensation, the time taken to solve the issues will affect the time allocated for the project completion hence delaying the project.

8. Design changes.

Constant changes of the project design will mean constant changes in the project's plan. Once the design is changed, it will take some more time to come out with a new design. This changes made will consequently delay the project.

4.4.7 Effects of Construction Delay.

The results were also analyzed by using SPSS to calculate the mean score of each factor. The mean score of the factors were ranked in descending order according to the scale chosen by the respondents. The factors with the highest mean score were considered to be the most severe effects caused by construction delays. This was represented on a table as showed below.

4.4.8 Kruskal Wallis H Test.

The Kruska Wallis test was carried using SPSS to determine if there are significant differences between the delay factors caused by clients, contractors and consultants. The results were reported as shown on **the table (4.12)** below.

Table 4.12 Kruskal Wallis H Test Ranks

Ranks

	Project participants	N	Mean Rank
Effects of delay.	Clients	18	32.50
	Consultants	14	21.50
	Contractors	13	20.50
	Total	45	

Table 4.13 Kruskal Wallis H Test Statistics

Test Statistics[a,b]

	Effects of delay.
Chi-Square	21.000
df	2
Asymp. Sig.	.023

a. Kruskal Wallis Test

b. Grouping Variable: Project participants

The results of the Kruska Wallis H test indicate that there was a statistical significant difference in the delay factors between the different groups of the project participants, $x^2 (2) = 21.000, p = 0.023,$ with the mean rank for each project stakeholder group being Clients (32.50), Consultants (21.50) and Contractors (20.50).

Table (4.14) shows Mean score and ranks of effects of construction delays.

Table 4.14 Mean score and ranks of effects

Descriptive Statistics			
Factors	N	Mean Score	Rank
Acceleration losses	45	3.64	1
Cost overrun	45	3.64	1
Time overrun	45	3.33	2
Disputes	45	3.20	3
Negative social impact	45	3.18	4
Litigation	45	3.11	5
Bankruptcy	45	3.04	6
Total abandonment	45	3.00	7
Create stress on	45	3.00	7

contractor			
Arbitration	45	2.76	8
Idling resources	45	2.76	8

4.4.9 Discussion

1. Acceleration of losses.

   When construction projects are delayed, the organization losses a lot of money and time in terms of increase cost and not being able to meet with its customers demand.

2. Cost overrun.

   This is one of the most common effects of construction delays. Delay in construction might lead to an increase in price of construction materials as well as price of labor.

3. Time overrun.

   Delay will cause the project to fall behind schedule. This is detrimental to the owner because he might not be able to meet up with his objectives on time.

4. Disputes

   Conflict will arise amongst project participants as to who will bear the responsibilities as a result of the delay.

5. Negative social impact.

   Delay in many community construction projects will have negative effects on the social structure such as riots strikes and boycott.

6. Bankruptcy.

When construction projects are delayed possibly due to finance, the organization will utilize most of its assets in order to complete the projects. If the delay persists, in attempt to finish the project, the company may run out of cash.

7. Litigation.

   If there is no agreement amongst the project participants as to who will bear the responsibilities of the project delay, either of them may file a law suit against each other.

8. Total Abandonment.

   Prolong project delay might lead to abandonment by the owner or contractor. This may be due to inadequate finance or expertise to successfully complete the project.

Figure (4.4) shows a bar chart of effects of construction delays and the mean values in descending order.

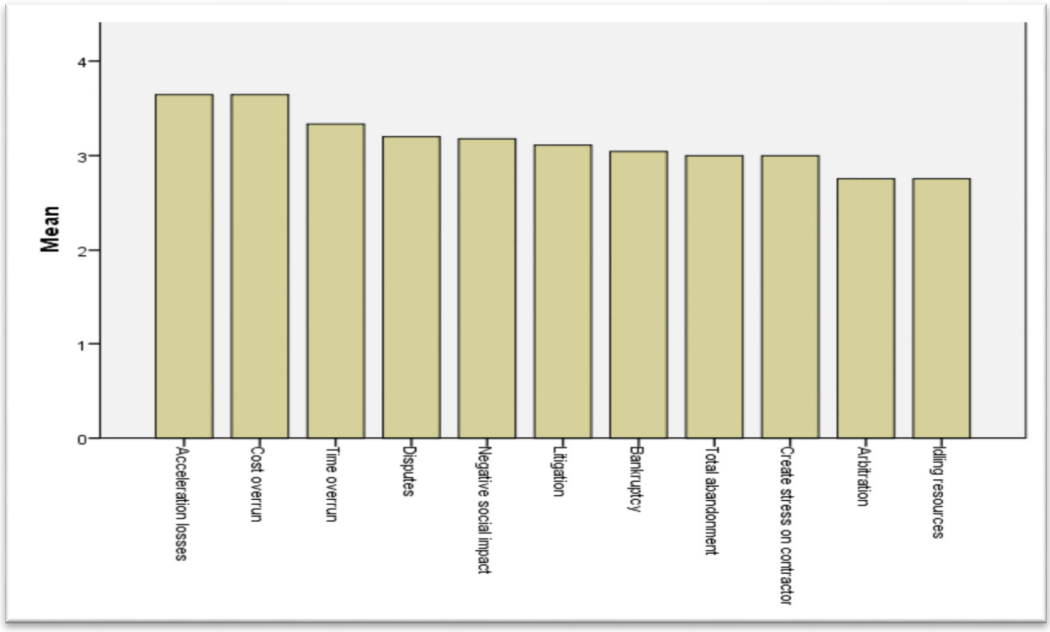


Figure 4.4 bar chart of effects of construction delay

4.5 Risks of Construction Delays

The obtained was analyzed using SPSS. The mean score of each of the factor was calculated and a ranking was done based on the mean values to observe the most predominant risks of construction delays according to the respondents. The factor with the highest mean was considered the most common risk of construction delay in the Sudanese construction industry. This was statistically as showed on the table below.

4.5.1 Kruskal Wallis H Test.

The Kruska Wallis test was carried using SPSS to determine if there are significant differences between the delay factors caused by clients, contractors and consultants. The results were reported as shown on **the table (4.15)** below.

Table 4.15 the differences between the delay factors caused

Ranks

	Project participants	N	Mean Rank
Risks of delay.	Clients	18	35.23
	Consultants	14	22.14
	Contractors	13	18.32
	Total	45	

Table 4.16 the Statistics

Test Statistics[a,b]

	Risks of delay.
Chi-Square	23.000
df	2
Asymp. Sig.	.012

a. Kruskal Wallis Test

b. Grouping Variable: Project participants

The results of the Kruska Wallis H test indicate that there was a statistical significant difference in the delay factors between the different groups of the project participants, $x^2 (2) = 23.000, p = 0.012,$ with the mean rank for each project stakeholder group being Clients (35.23), Consultants (22.14) and Contractors (18.32).

4.5.2 Discussions

1. Too much pressure.

   This is a major risk that arises as a result of project delay. When projects are delayed, the owner mounts too much pressure on the contractor and his team. The end result is a poor quality job by the contractor in order to meet his clients demand.

2. Price Inflation.

   The prices of construction materials fluctuate over time. As such if construction projects falls behind schedule, there is a tendency that the material prices will increase.

3. Disputes.

   Conflict will arise amongst project participants as to who will bear the responsibilities as a result of the delay.

4. Total Abandonment.

   Prolong project delay might lead to abandonment by the owner or contractor. This may be due to inadequate finance or expertise to successfully complete the project.

5. Cost increase.

   This is one of the most common effects of construction delays. Delay in construction might lead to an increase in price of construction materials as well as price of labor.

6. Arbitration.

When projects are delayed and dispute arises, in an attempt to solve the conflicts, the project stake holders might seek in a third party for solution. Seeking an arbitrator will further increase the cost of the project.

7. Loss of Confidence.

   This will mostly affect contractors and consultants. This is because when projects are delayed without any tangible explanations, the owner will start questioning their expertise. This alone can cause them to loose many contracts to competitors.

8. Litigation.

   If there is no agreement amongst the project participants as to who will bear the responsibilities of the project delay, either of them may file a law suit against each other.

Table (4.17) shows mean score and ranking of the risks associated with construction delays:

Table 4.17 mean score and ranking of the risks associated

Descriptive Statistics			
Risk of Construction Delay	**N**	**Mean**	**Rank**
Too much Pressure	45	3.89	1
Price Inflation	45	3.80	2
Disputes	45	3.60	3
Project Abandonment	45	3.56	4
Overall cost increase	45	3.56	4
Decline in Revenue	45	3.56	4
Arbitration	45	3.27	5

Loss of Confidence	45	3.20	6
Litigation	45	2.98	7
Change of Contractor	45	2.89	8

4.5.3 Risks of construction delays

This refers to the stakeholder who carries the highest risk in case the construction project is delayed.

Table 4.18 mean score and ranking of the risks associated

Client	Mean	Consultant	Mean	Contractor	Mean
Price inflation	3.80			Too much pressure	3.89
Overall cost increase	3.56			Disputes	3.60
Decline in revenue	3.56			Arbitration	3.27
Project abandonment	3.56			Loss of confidence	3.20
				Litigation	2.98
				Change of contactor	2.89

From the above table it can be observed that the clients and the contractors suffer high risks as a result of construction delay. The consultant has no major direct risk to share. The contractor shares most of the risks with the most important being too much pressure from the clients and other stake holders. On the other hand the client most important risks are price inflation of materials and overall cost increase of the project.

Figure (4.5) shows a bar chart of the delay risk factors and the mean values.

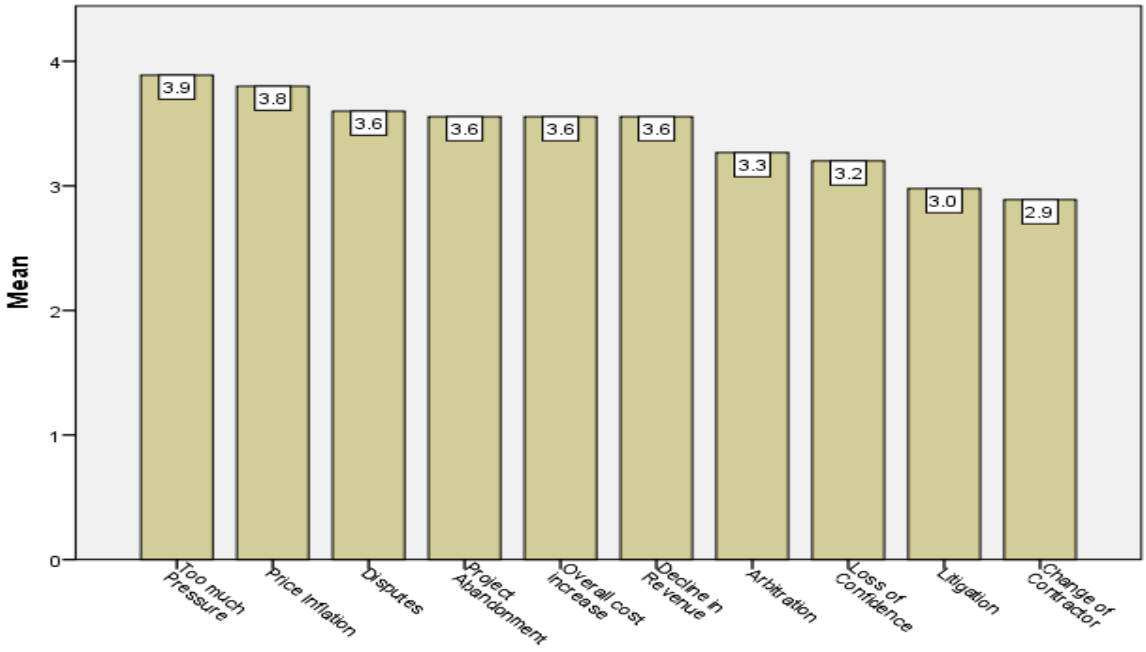


Figure 4.5 bar chat of the delay risk factors

4.6 Mitigating Risks of Construction Delays

The data obtained from respondents were analyzed using SPSS by computing the mean score for each factor according to the respondent's responses. The mean scores were ranked from the highest to the lowest and represented on a statistical table. The risk mitigating factor that scored the highest mean was considered to be a very highly effective means of eliminating risks associated with construction delay in the Sudanese construction industry. This is showed on the table below.

4.6.1 Kruskal Wallis H Test.

The Kruska Wallis test was carried using SPSS to determine if there are significant differences between the delay factors caused by clients, contractors and consultants. The results were reported as shown on **the table (4.19)** below.

Table 4.19 differences between the delay factors caused by clients, contractors and consultants

Ranks

	Project participants	N	Mean Rank
Delay mitigation	Clients	18	15.53
	Consultants	14	24.17
	Contractors	13	20.42
	Total	45	

Table 4.20 the test statistics

Test Statistics[a,b]

	Delay mitigation.
Chi-Square	22.000
df	2
Asymp. Sig.	.032

a. Kruskal Wallis Test

b. Grouping Variable: Project participants

The results of the Kruska Wallis H test indicate that there was a statistical significant difference in the delay factors between the different groups of the project participants, $x^2 (2) = 22.000, p = 0.032,$ with the mean rank for each project stakeholder group being Clients (15.53), Consultants (24.17) and Contractors (20.42).

4.6.2 Discussions

1. Information sharing.

   This involves exchange of information amongst the project stakeholders throughout the course of the project construction. This will play a very important role in minimizing the delay factors.

2. Total Quality Management.

   The organization's management including the project stakeholders to always strive to provide for their customers and clients the best quality products within the allocated time will greatly reduce the chances of delay.

3. Quality Cycle.

   A group of employees in the project construction team should be designated to occasionally meet and discuss about quality throughout the construction phase.

4. Benchmarking.

   Information from already completed or ongoing projects should be used to compare the performance of the construction project in question.

5. Joint Risk management.

   All the project stakeholders should collaborate in sharing and solving of the risks that are involved throughout the project construction phase. This will enable a better understanding of the risks of delay and appropriate measures put in place to tackle them.

6. Continuous training

Training in both onsite and offsite should be a continuous process in the project construction. This will add up to the employees' efficiency to perform their tasks within the shortest time possible without a fall in the quality of the job done.

7. Automated material tracking.

   Regular monitoring of the construction materials will easily signal when there is shortage. Thus this will reduce the risks of delay due to material shortages.

8. Early involvement of Contractor.

   Involving the contractor at the early stage of the project will give him enough time to plan recruit the best talents to work with him.

9. Collaborative logistics

   All the project stakeholders should corporate in the transportation of construction materials from and to the site. It should not be left alone to the contractor. This will reduce the causes of delay due to late delivery of materials.

10. Cross firm incentive system.

    The incentive system should cut across all members of the organization and should be similar to what other firms are giving to their employees. With this system the employees will feel motivated to perform their tasks effectively.

Table (4.21) shows the Mean score of Risks factors due to construction delay and their rankings.

Table 4.21 the Mean score of Risks factors due to construction delay

Descriptive Statistics			
factors	N	Mean	Rank
Information sharing	45	3.93	1
Total Quality Management	45	3.67	2
Quality circles	45	3.62	3
Benchmarking	45	3.5333	4
Joint Risk Management	45	3.51	5
Continuous trainings	45	3.44	6
Automated Material Tracking	45	3.4222	7
Early involvement of contractor and subcontractor	45	3.27	8
Collaborative Logistics	45	3.2444	9
Introducing “No Dispute clause” in contracts	45	3.18	10
Cross firms Incentive System	45	3.18	10
Automated Construction Activity Tracking System	45	3.02	11
Performance-based Contracting	45	2.56	12

Figure (4.6) show a bar chart of the construction risks mitigating factors.

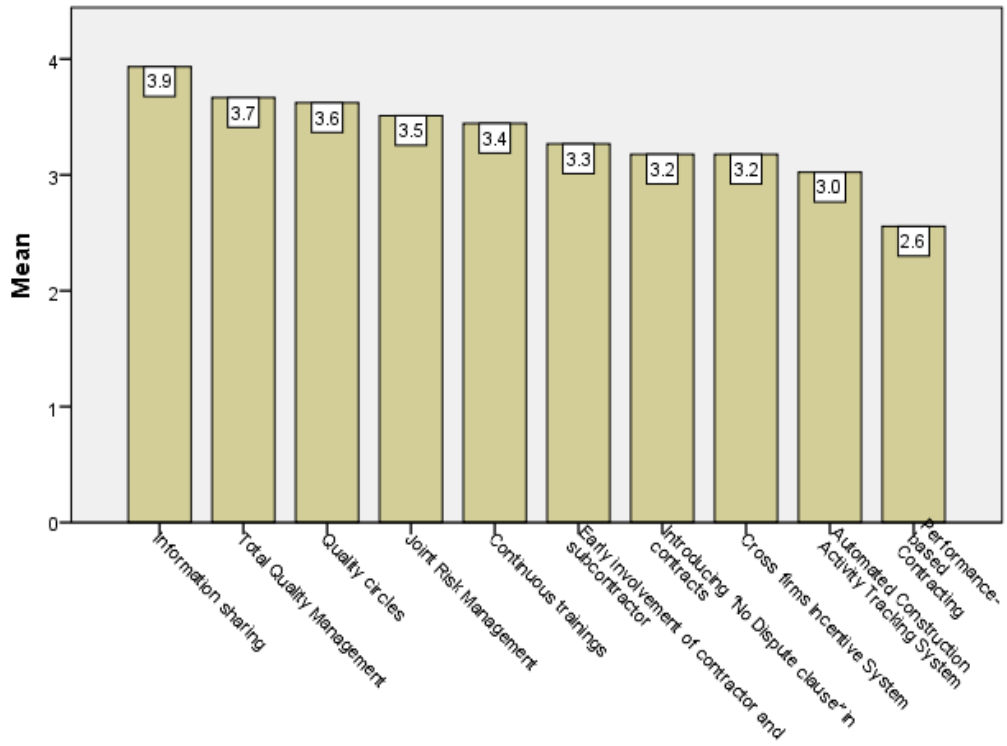


Figure 4.6 bar chart of the construction risks mitigating factors

4.7 DISCUSIONS

Based on our research in the Sudanese building construction industry, we discovered the top 10 most common causes of delay. These were; fluctuation of prices of construction materials, shortage of materials, inaccurate time estimation, errors during construction, improper planning, delay in payment to contractors, compensation issues, design changes and inaccurate cost estimation. It is observed that majority of the delay factors are Contractor and Consultant related, while the client also play a role in the delay in terms of compensation issues and design changes and delay in payment of contractors.

As for the effects of delay in Sudanese building construction industry, it shares same ranking as what has been observed in other countries by past researchers. The 5 top most common effects were; Cost overrun, acceleration of losses, time overrun, negative social impacts and litigation. These factors were also observed to be the top ranking effects of construction delays in other countries thus making them universal.

The top most common risks associated with building construction delays in Sudan were observed to be; too much pressure on project stake holders, price inflation of materials and overall project, disputes amongst project participants, project abandonment, overall cost increase and decline in revenue.

As earlier mentioned, different countries will experience different causes of building construction delay, different effects, and different risks and will apply different measures to eliminate those risks that are suitable for that particular country. In Sudan the top 8 most common measures of eliminating construction delays, as recommended by projects participants were observed to be; Information sharing, Total Quality Management (TQC), Quality cycles, Benchmarking, Joint risk management, continuous trainings, automated material tracking and early involvement of contractor and subcontractors.

4.8 Conclusion

Just like any other construction industries, the Sudanese construction industry is also prone and liable to delay. But however the factors that causes delay in construction industry varies across different countries based on the political and socio economic condition of a particular country. The extent or the severity of the delay factors are also being influenced by this same conditions. In addition the environmental conditions of a

country will significantly influence the extent to which construction projects are delayed as well as the types and the magnitude of the risks involve. This will also determine the effects that will arise and the kind of measures that will be suitable to effectively mitigate or eradicate all these obstacles. All these measures will vary from country to country. Different countries will apply different measures.

CHAPTER 5

5 RECOMMENDATION AND CONCLUSION

5.1.1 RECOMMENDATION

Building construction delay is an inevitable phenomenon that occurs in almost every country due to a combination of the factors investigated above. However construction delays turn to be very common occurring now and then in most developing countries especially countries in Africa. This may be due to lack of in adequate financial resources to successfully complete projects on time. It could also occur as a result of natural disasters or environmental hazard that is very common in most African countries. In addition it could also be due to lack of technical expertise, poor construction skills and labor intensive as oppose to capital intensive in developed countries. African countries are also seen as a hub for corruption which can also answer the question why delay is construction is mostly common in these countries. Another very obvious reason could be the shortage of material supplies since most African countries don't produce their own building materials. Majority are being imported from other countries.

Taking all the above mentioned points into consideration and in order to reduce or mitigate these delay factors, we therefore recommended the following measures to be implemented in Sudan and other African countries;

- Setting up factories to produce building construction materials in the country. This will reduce the chances of delay occurring due to shortage of materials since there

will be a constant flow of materials supply. The time taken for the materials to leave the manufacturing base to the construction will also be shortened. Finally the cost of the materials will be reduced as there will no tax levied on imports and excised duties.

- The government in collaboration with other stakeholders should invest heavily in human capital development by training construction workers with the right technical skills to become efficient. With this kind of measure in place Sudan can construct quality infrastructure without seeking costly assistance from companies. In addition it will make the country to be more competitive in the global market.

- The government should also ensure that project bidding should be based on experience and expertise in a particular area and not full of cronyism. With this in place it implies the best company will get the project and will be completed within the time allocated without any delay.

- We also strongly recommended future researchers who wish to investigate on this area of study related or closely related to Sudan, should focus on building construction projects in other parts of the country since this was limited only to the capital city Khartoum. Moreover the sample size was also small so future researchers could take a bigger sample size in order to produce a more valid results. Finally the survey was conducted through online distribution of questionnaires via emails and there were many errors. Thus future researches should be conducted by visiting the construction sites, getting in touch with the project stakeholders and collecting the data. This will help reduce the chances of errors.

5.1.2 CONCLUSION

The consequences of building construction projects are always negative thus delay should be avoided at all cost. To avoid construction delays, it is imperative for project participants to first of all identify the possible factors that can cause delay and label them as critical success factors. Once these factors have been identified, suitable preemptive measures can also be put in place to counter the negative effects that may arise as a result of their occurrence.

The already identified delay factors can then be traced to their possible causes that are due to either contractor, consultants, clients, environmental, government or others. With all this resolution method put in place it will be very easier to identify whoever is at default.

Sudan is an underdeveloped country lacking all the resources needed to successfully complete a building construction project within the allocated time and budget. This has had adverse effects on infrastructural development aspect of the economy and also its construction industry reputation in the global market. Therefore it is not doubtful that the government and private institution keep spending huge amount of money on construction projects which are later delayed and some abandoned.

From our findings, we conveniently pointed out that the most common causes of construction project delays were, fluctuation of prices of construction materials, shortage of materials, inaccurate time estimation, errors during construction, improper planning, delay in payment to contractors, compensation issues, design changes and inaccurate cost estimation.

In addition the most common effects of construction delays were proven to be; Cost overrun, acceleration of losses, time overrun, negative social impacts and litigation. Meanwhile the most common risks associated with construction delay were; too much pressure on project stake holders, price inflation of materials and overall project, disputes amongst project participants, project abandonment, overall cost increase and decline in revenue. And finally the most effective measures of eliminating delays in construction were; Information sharing, Total Quality Management (TQC), Quality cycles, Benchmarking, Joint risk management, continuous trainings, automated material tracking and early involvement of contractor and subcontractors.

From the survey conducted and analysis, it was discovered that most of the factors causing delay in the Sudan's construction industry are due to the clients. Most of the factors were financial related because of the economic situation of the country. The next stakeholder responsible for causing delay is the contractor due to inadequate skills.

Moreover in terms of risks that arise as a result of delay, the client again carries the highest risk because he is the investor followed by the contractor who executes the project. The consultant on the other hand has very little or no risk associated with delays.

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