



بسم الله الرحمن الرحيم



**Sudan University of Science and Technology**  
**College of Graduate Studies**

**Effects of delay in the Construction Industry**

**Case Study: (Central Market Khartoum)**

**أثر التأخير في صناعة التشييد**

**دراسة حالة: (السوق المركزي - الخرطوم)**

*A Thesis Submitted in Partial Fulfillment of the Requirement for  
Degree of M.sc. in Construction Managements*

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## الآية



{ أَمَّنَ الرَّسُولُ بِمَا أُنْزِلَ إِلَيْهِ مِنْ رَبِّهِ وَالْمُؤْمِنُونَ كُلٌّ آمَنَ بِاللَّهِ وَمَلَائِكَتِهِ وَكُتُبِهِ وَرُسُلِهِ لَا نُفَرِّقُ بَيْنَ أَحَدٍ مِنْ رُسُلِهِ وَقَالُوا سَمِعْنَا وَأَطَعْنَا غُفْرَانَكَ رَبَّنَا وَإِلَيْكَ الْمَصِيرُ (285) لَا يُكَلِّفُ اللَّهُ نَفْسًا إِلَّا وُسْعَهَا لَهَا مَا كَسَبَتْ وَعَلَيْهَا مَا اكْتَسَبَتْ رَبَّنَا لَا تُؤَاخِذْنَا إِنْ نَسِينَا أَوْ أَخْطَأْنَا رَبَّنَا وَلَا تَحْمِلْ عَلَيْنَا إِكْرَامًا كَمَا حَمَلْتَهُ عَلَى الَّذِينَ مِنْ قَبْلِنَا رَبَّنَا وَلَا تُحَمِّلْنَا مَا لَا طَاقَةَ لَنَا بِهِ وَاعْفُ عَنَّا وَارْحَمْنَا أَنْتَ مَوْلَانَا فَانصُرْنَا عَلَى الْقَوْمِ الْكَافِرِينَ (286) }

صَدَقَ اللهُ الْعَظِيمُ،

الآيتان (285) و (286) من سورة البقرة

## **Dedication**

**To My SOUL Father...**

**To My Mother...**

**To My Friends And Colleagues..**

## **Acknowledgements**

I would like to express my special appreciation to my supervisor

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For the guidance, assistance, criticism, and suggestions on this research

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## **Abstract**

The construction industry in Sudan is an important sector due to its enormous contribution to the country's economic development. However due to the geographical, political, social and economical situation of the country, many construction projects are prone to many factors of delay. These delay factors can only be avoided by first identifying the factors and their sources. The research aimed to find out and analyze the main causes of delay in construction projects. The research was designed to identify the possible causes of delay at construction projects from the literature review and previous studies which there are over than thirty causes of delay were displayed, then these causes tested by the analyzing the data and information that were collected from clients, consultants and contractors, researcher conduct site visits to interpretation the causes of delay that emerged during the implementation of the project. The analysis of correspondences letters between project parties; contractor, client, and consultant lead to characterize investigate are project finance, design changes, fluctuation of prices and incomplete design. The research defines who is responsible and type of delay in addition to the discussion of effects, risks, and mitigating of delay. Finally the research concluded with Recommendations such as security funding for the project at the project preparation stage, the contractors should be classified according to the experience which commensurate with the size of the project, The application of value engineering to avoid incomplete design problems , it's also strongly recommended future researchers to focus on building construction projects in other parts of the country since this was limited only to the capital city Khartoum through the case study.

## المستخلص

صناعة البناء والتشييد تمثل قطاعا هاما في السودان نظرا لمساهمته الهائلة في التنمية الاقتصادية للبلاد. ولكن نظرا للواقع الجغرافي والسياسي والاجتماعي والاقتصادي للبلاد، العديد من مشاريع البناء عرضة لكثير من عوامل التأخير. عوامل التأخير هذه يمكن تجنبها عن طريق تعريف هذه العوامل وتحديد مصادرها.

هذا البحث يهدف لمعرفة وتحليل الأسباب الرئيسة للتأخير في مشروعات البناء. تم تصميم البحث لتحديد الأسباب المحتملة للتأخير في مشروعات البناء من خلال الجانب النظري والدراسات السابقة حيث هناك أكثر من ثلاثين سبب للتأخير تم عرضها، ثم اختبار هذه الأسباب من خلال تحليل البيانات والمعلومات التي تم جمعها من العملاء والاستشاريين والمقاولين من خلال وثائق المشروع والزيارات الميدانية وذلك لتوضيح أسباب التأخير التي ظهرت أثناء تنفيذ المشروع بالإضافة إلى توضيح المسؤوليات وآثار ومخاطر التأخير.

من خلال تحليل وثائق المشروع وجد أن معظم أسباب التأخير كانت بسبب تمويل المشروع، والتغير في التصميم، تذبذب الأسعار، والتصميم غير المكتمل. وأخيرا تضمن البحث توصيات مثل ضمان تمويل المشروع في مرحلة الاعداد للمشروع، تصنيف المقاولين بناء على خبره التي تتناسب مع حجم المشروع، تطبيق هندسة القيمة لتجنب مشاكل التصميم غير المكتمل، أيضا نوصي بشدة الباحثين في المستقبل الذين يرغبون في التحقيق في هذا المجال من الدراسة المتعلقة أو المتصلة بالسودان، ينبغي أن تركز على بناء مشاريع البناء في أجزاء أخرى من البلاد حيث اقتصر هذا البحث فقط على العاصمة الخرطوم من خلال دراسة الحالة.

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# **CHAPTER ONE**

## **INTRODUCTION**

### **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)

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).

Sudan is a developing country; never the less it is witnessing in the recent years development projects in a number of areas, including the construction sector. There has been a major development in the field of construction, which included all sectors of residential, industrial, service and others such as homes, schools and hospitals.

### **1.2 Research Problem**

In Sudan, most construction projects subject to delays, especially government projects while Project success can be defined as meeting goals and objectives as prescribed in the project plan, within budget limits, quality and

completion of a time. Therefore, project delays leads to huge losses to states and individuals, and loss of investments, failure of the companies, and recourse to the judiciary to resolve disputes.

### **1.3 Significant of research**

Delays are costly and often result in disputes and claim, many projects suffer from extensive delays and that way exceed initial time and cost estimates. In addition to extensive delays provide a fertile ground for costly disputes and claims.

Also In many studies find that the blame is always thrown to the contractor, but there are numerous types of delays have been caused by other parties.

### **1.4 Hypotheses**

1. Delay leads to increases of project costs.
2. Delay leads to poor quality.
3. Delay causes Disputes amongst project participants, “Contractors are constantly loosing contracts due to delay or incomplection of projects”.
4. 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”.

### **1.5 Objectives**

This research presents to identifying the most important factors of delays in construction projects in Sudan and responsibility and type so as to try to avoid them in the future and contribute to help to overcome the problem of delay and its consequences, and that is through:

- identifying the factors of delays
- Determine the risks associated with construction Project delay
- Investigate the effects of delay

## **1.6 Structure of the Research**

### **1.6.1 Chapter 1**

This chapter outlines, introduction about subject of research, problem statement and illustrates the aim and the hypothesis of the study and specific objectives.

### **1.6.2 Chapter 2: Literature Review, Theory Related**

Chapter two involve of the literature review, which brings out the main sources of the secondary data collection deals with the extant literature. It is an overview of the causes of construction delays, effects of delay, risks associated with delay. It also includes theoretical framework of previous studies.

### **1.6.3 Chapter 3: Research Methodology:**

This chapter describes the Methodology used to conduct the research. It also includes the Geographical Scope, Time scope, Research Sample, and finally how the Data Collection.

### **1.6.4 Chapter 4: result and discussion:**

This chapter includes the primary data which was collect by site visiting, documents, interviews, and secondary data from literature review, also includes a discussion of data.

### **1.6.5 Chapter 5: Conclusions and recommendations:**

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

# **CHAPTER TWO**

## **LITERATURE REVIEW**

### **2.1 Introduction**

Many talked about the importance of construction industry, where it has seen considerable development in the recent period, according to the evolution of man and his need for buildings that keep pace with this development.

Construction activity is an integral part of a country's infrastructure and industrial development. It includes hospitals, schools, townships, offices, houses and other buildings; urban infrastructure (including water supply, sewerage, drainage); highways, roads, ports, railways, airports; power systems; irrigation and agriculture systems; telecommunications etc. Covering as it does such a wide spectrum, construction becomes the basic input for socio-economic development. Besides, the construction industry generates substantial employment and provides a growth impetus to other sectors through backward and forward linkages. It is, essential therefore, that, this vital activity is natured for the healthy growth of the economy.

Where different construction industry from other industries in the physical nature of their products as a product of the magnitude scale and the need to be manufactured at the site of this investment, which requires transmission of workshops and implementation to the construction site (Khairallah and Eid , 1990). The construction industry can be described as a collection of industries, because a completed building is generally composed of an assembly of building materials, components and equipment produced by other industries (Kwakye , 1998). What we see today from a humanitarian cultural heritage clearly evident through the products of this industry through different historical phases (Jalali , 2000) . Moreover, construction has unique characteristics deriving largely from



the physical nature of the product and consists of a group of activities interconnected by the nature of their products, technologies and institutional settings.

### **2.1.1 The Importance of the Construction Industry**

Construction is an important industry due to the variety of demand for the essentials project in the life of any nation, which the industry must satisfy:

- The demand for housing construction
- The demand for building construction such as commercial social uses etc
- The demand for heavy engineering construction
- The demand for industrial construction including factories etc.

The construction industry has single characteristics, which are shared by other industries, but in combination they appear in construction alone, making it worthy of different treatment. These characteristics fall into three main groups, which are:

- The physical nature of the product,
- The structure of the industry together with the organization of the construction process.
- The method of price determination. (Turin; 1973).

### **2.1.2 The nature of the construction industry**

Construction process is the whole series activities between the initiating point of a client needs and the production of a building to fulfill these needs. There are certain characteristics that distinguish a project from a production process.

The most important of these are:

That it is a non -repetitive on in operation of building. Although the organization may be repeating the same job, every project is a unique exercise,

that it has a clearly identifiable beginning and end and that significant changes in its environment and internal operating conditions take place through its

Duration.(Tavistock Report, 1963).

The nature of the construction process is labour-intensive. Construction, as an important factor in development, is comparatively less dependent on fixed capital even in developed countries. (Strassmann , 1970) quoting M. Arthur

Lewis:

"Roads, viaduct, and irrigations canals can be created by human labour with hardly any capital to speak of. Following RagnenNurkse and writers of general development book, (Strassmann , 1970) argues that under-employed or surplus labor could be used with little capital in buildings community development projects or self-help dwelling.

As has often been noted, construction tended to be labour-intensive actually even in industrialized countries (Strassmann , 1970).

Construction is relatively labor-intensive in the sense that it uses a larger number of workers per unit of output than that of most other industries.

### **2.1.3 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.
- 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 populations grows with economic development, but with different rates of change.
- 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.

#### **2.1.4 The role of construction in economic development**

The construction industry in both developed and developing countries may be viewed as that sector of the economy which, through planning, design, construction, maintenance and repair, and operation, transforms various resources into constructed facilities. The types of public and private facilities produced range from residential and nonresidential buildings to heavy construction, and these physical facilities play a critical and highly visible role in the process of development.

The major participants from the construction industry include the architects, engineers, management consultants, general contractors, heavy construction contractors, special trade contractors or subcontractors, and construction workers, along with the owners, operators, and users of the constructed facility. Building finance and insurance agencies, land developers, real estate brokers, and material and equipment suppliers and manufacturers, among others, are also involved in construction but are generally considered as distinct from but ancillary to the construction industry. The government interacts with the industry as purchaser, financier, regulator, and adjudicator.

The regulatory environment with in which the construction industry operates is also important and includes, for example, building and related codes, licensing requirements, safety legislation, and financial institution operating rules. Most developing, as well as developed, countries put over 55 percent of their gross domestic investment into the creation of the physical facilities, including infrastructure, so necessary for development (10, 26). Moreover, the construction industry plays a key role in satisfying a wide range of physical, economic, and social needs and contributes significantly to the fulfillment of various major national goals. The industry's sizes, the nature of its operation, and its presence in every developmental activity have made construction an attractive area for experimentation in enhancing the effectiveness of international assistance and cooperative works.

Construction is the only sector of economic, which appears twice in the national accounts presented according to the United Nations recommendations.

It is one of the eleven sectors of analysis of Gross Domestic Product (GDP) at the factor cost by industrial origin; but construction is also a component of fixed capital formation in the composition of Gross Domestic Capital Formation (GDCF) by the type of assets. Finally, construction appears as a separate entry in labor statistics reported by the International Labor Organization.

A major difficulty in doing a quantitative study of the construction industry is a lack of accurate, detailed, and comparable data. In large part, this is due to the diverse nature of the industry in terms of, for example, its large size; fragmentation; geographic and product-type dispersion; reliance on a labor force, materials, and equipment which are widely used by other industries; and its association with numerous ancillary industries. In developing countries in particular fluctuating demand markets, which may be distorted by single but large projects and construction's sensitivity to political and economic

uncertainty, impair statistics, along with the fact that it is difficult to determine the contribution of the non-monetary sector of construction. These difficulties are further compounded by the general lack of statistics on developing countries and the problem of incomparability of data collected on different countries.

#### **2.1.5 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% in 2008. The sector is part of the revamping urban infrastructure estimated to cost some \$7 billion. 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.

#### **2.1.6 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).

### **2.2 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.

### **2.3 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. Non excusable delays. This results from contractors' own fault or his subcontractors or materials. This may be sometimes due to lack of experience.

### **2.4 Types of delay**

The type of delay falls into two major categories, excusable and non excusable (Terry Williams, 2003) revealed that there are three basic ways to classify delays:



1. **Excusable:** Excusable delay is “a delay to completion which is caused by matters deemed to be outside the control of the contractor” (Pickavance , 1997). It excuses a contractor from performing within the contract period and justifies an extension of time to perform.

This type of delay can also have an impact on non-critical activities which need more detailed analysis to determine whether additional time extension is warranted or if the reduction of float time can be justified. Generally, whether delays are excusable depends on contract provisions. Acts of God, unexpected weather, labor disputes, owner design problems, owner-initiated changes and similar factors may cause excusable delays.

Excusable delays, also known as “force majeure” delays. These delays are commonly called “acts of God” because they are not the responsibility or fault of any particular party. Most contracts allow for the contractor to obtain an extension of time for excusable delays, but not additional money (Alaghbari , 2007).

The main consideration is whether the factors were beyond the contractor's ability to control or foresee. In other words, delays are generally excusable when another party caused but could have avoided them, or when they were due to environmental factors beyond the control or foresight of anyone.

Excusable delays can be further classified into compensable and no compensable.

- **Compensable Excusable Delays:** Excusable compensable delays are caused by the owner or the owner's agents. A compensable delay usually leads to a schedule extension and exposes the owner to financial damages claimed by the contractor. However, “in some special circumstances a

compensable delay does not always mean that additional time is due. Sometimes only additional costs will be compensable” (Callahan, 1992).

Examples of this would be the late release of drawings from the owner's architect, failure of the owner to hand over the site to the contractor or major changes in the scope of work.

Excusable with compensation are caused by the client's actions or inactions.

When contractors encounter this type of delay, they are entitled to time extension as well as monetary compensation due to the delays. An example of an excusable delay with compensation would be when an owner denies access to the site once the notice to proceed is given.

This delay is because come sometime unexpected situation and it not from mistake of the contractor. The external factor is something hard to make sure because it refer to the future and event In addition to the compensable delays that result from contract changes by Change Notice, there are compensable delays that can arise in other ways. Such compensable delays are excusable delays, suspensions, or interruptions to all or part of the work caused by an act or failure to act by the Owner resulting from Owner's breach of an obligation, stated or implied, in the contract. If the delay is compensable, then the Contractor is entitled not only to an extension of time but also to an adjustment for any increase in costs caused by the delay.

Owner-issued contracts specifically address some potential compensable delays and provide equitable adjustments. The usual equitable adjustment clauses in Owner issued contracts that apply to delay are: Changes, Differing Site Conditions, and Suspension.

- **Excusable non-compensable delays:** Excusable non-compensable delays are caused by third parties or incidents beyond the control of both the owner and the contractor. In this case “the contractor is entitled to a

time extension without the recovery of associated cost of damages” (Leon, 1987). Each party (owner and contractor) must pay his own part of the delay cost. Examples typically include acts of God, unusual weather, strikes, fires and acts of government in its sovereign capacity.

Excusable without compensation are delays where neither the client nor the contractor is deemed responsible. When this type of delay is encountered, only a time extension will be warranted since there are no grounds for damages.

This delay is allow to the ex tends of time to finish construction without give any compensation to the contractor. The factor that include of this delay is:

- a. Protest from the labor.
- b. Unexpected weather.
- c. UNIX Pecked of late delivery equipment.
- d. Unexpected of late delivery material.

Non-compensable delays are caused by third parties or of both the owner and the contractor.

Examples typically include acts of God, incidents beyond the control unusual weather, strikes, fires, acts of government in its sovereign capacity, etc. In this case, the contractor is normally entitled to a time extension but no compensation for delay damages, Owner or the owner’s agents. An example of this would be the late release of drawings from the owner's architect. An excusable, compensable delay usually leads to a schedule extension and exposes the owner to financial damages claimed by the contractor. In this case, the contractor incurs additional indirect costs for both extended field office and home office overhead and unabsorbed home office overhead.

## **2. Non-excusable:**

Non- Excusable delay are caused solely by the contractor or its Suppliers. The contractor is generally not entitled to relief and must either make up the lost time through acceleration or compensate the owner. This compensation may come about through either liquidated damages or actual damages, providing there is no liquidated damages clause in the contract.

Liquidated damages are generally expressed as a daily rate that is based on a forecast of costs the owner is likely to incur in the event of late completion by the contractor.

This delay cause by avoid the contract agreement by contractor and it was identify by construction contract. Client can claim their loss if had in the contract agreement. These delay had to identify by client because they rarely to check the schedule of the construction. The factor that contribute to the non excusable delay:

1. The usual weather and as expected weather.
2. The inefficiency of contractor to manage the construction site.
3. The financial of contractor.
4. The lack of labor.
5. Failure to manage their work according to the contract schedule.
6. Always make mistake or failure to fulfill of owner specification.
7. Prosecute the work in a timely manner.
8. Properly staff the job.
9. Order materials or equipment on time.
10. Submit shop drawings for approval on schedule.
11. Coordinate the work of its subcontractors.

Based on the above theoretical side can be illustrated

Classified delay factors by diagram below:

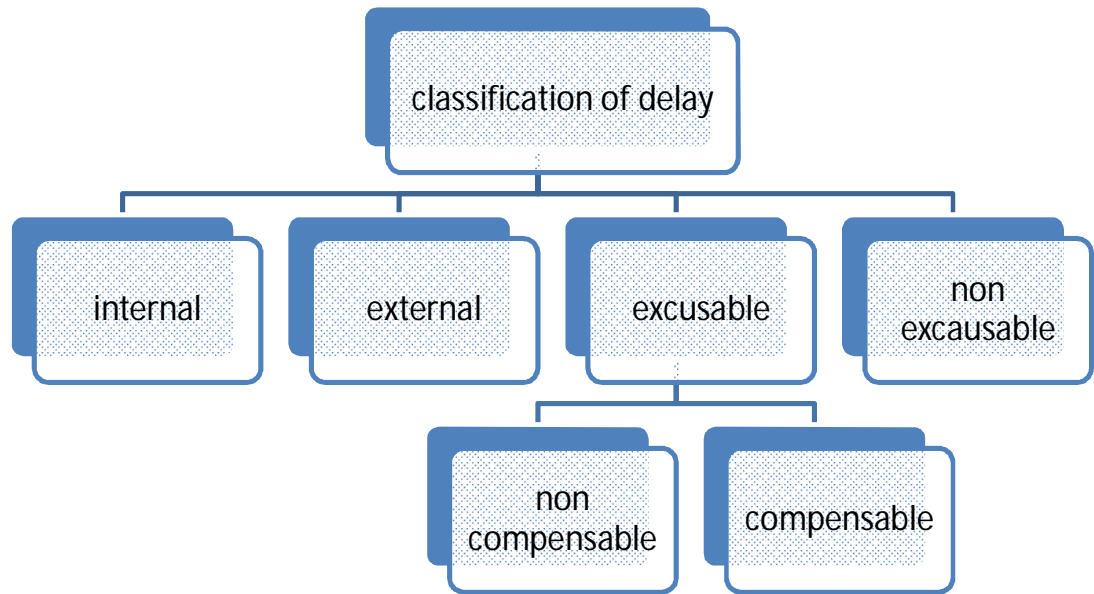


Fig. (2. 1) classification / type of delay

## 2.5 Causes of delay

### 2.5.1 Previous studies

The researchers identified a variety of categories and causes of delays, using methods appropriate to their particular studies. As the field has developed, it has become easier to conduct studies into construction delay, since many categories of delay factors have already been identified.

Consequently, most recent studies have relied on the categorization of causes identified in the existing literature.

Many studies have also been carried out to assess the causes of such delays.

The main causes of delay in large building projects and their relative importance 56 causes of delay exist in Saudi construction projects and conclude that contractors, consultants, and owners generally agree on the importance ranking of delay factors. Contractors considered the most important delay factors to be the preparation and approval of shop drawings, delays in payment by the owner,

and design changes. The most important delay factors for the consultants were cash problems, the relationship between different subcontractor schedules, and slow decision making by the owner. The owners considered the most important delay factors were design errors, excessive bureaucracy in project-owner organization labor shortages and inadequate labor skills. Delay factors were categorized into nine groups, of which financing was unanimously ranked highest (Assaf and Al-khalil ,1995).

From 12 high-rise building construction projects in Bangkok founded the most projects suffered delays because materials were in short supply or were overstretched. Demands from construction owners for frequent changes also technical personnel created design and coordination problems for field staff (Jearkjirm , 1996) conducted a survey into the causes of time overruns in Hong Kong construction projects, finding that all three major groups of industry participants (contractor, consultant and client) felt that the five most significant sources of overrun were site management and supervision, unforeseen ground conditions, low speed of decision making involving all project teams, client initiated variations and necessary variations of works (Chan and Kumaraswamy , 1997).

In SA founded that the most important cause of delay is cash flow and other financial difficulties. Difficulties in obtaining permits is the second most important, followed by the government practice of awarding contracts to the lowest bidder without regard to qualification and the tendency of clients to underestimate project duration. They also found that the contractor is most commonly responsible for project delay (44%), followed by the client (22%) and the consultant (14%) (Khalil and Al-Ghafly , 1999).

From 130 public building projects constructed in Jordan during the period

1990-1997 founded the main causes of delay in construction projects relate to designers, user changes, weather, site conditions, late deliveries, economic conditions and increase in quantities (Al-Moumani , 2000).

It has been shown above that a large number of causes may lead to delays in construction projects, arising from different parties and resources. These causes are in a sense countless, since each construction project has its own characteristics and environment. Efforts have therefore been made by many authors to identify the most significant causal factors of delay in construction projects.

The researchers select the causes most appropriate to the present study from a number of previous studies, with a high probability of covering all significant sources of delay. In addition, the major categories of causes of delay are identified, based on several previous studies, to match the purpose of this study.

The causes of construction delay as defined for this study will be discussed in a wide perspective, In order to obtain full understanding of the subject.

### **2.5.2 Case study 1**

Khartoum international airport (kiynia)

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).

### **2.5.3 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).

Bina Puri 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.

From previous studies, we find that there are several factors that cause delay in construction. Delay may be caused by clients, users, consultants, designers, owners, contractors and suppliers, the table (2.1) below shows that.

### **Causes of delay attributed to contractor:**

#### **Materials:**

- 1- Shortage of required materials
- 2- Delay in material delivery due to poor transportation and expediting arrangements.
- 3- Changes in materials prices
- 4- Changes in materials specifications
- 5- Delay in placing Purchase Orders for long lead items.
- 6- Delays due to the wrongly delivered material to site.

#### **EQUIPMENT:**

- 1- Shortage of required equipments
- 2- Failure of equipment
- 3- Inefficient equipment
- 4- Inadequate equipment used for the work

## **MANPOWER:**

- 1-Shortage of manpower ( skilled , semiskilled, unskilled labor)
- 2- low skill of manpower

## **Project Management:**

- 1- Shortage of Contractor 's administrative personnel
- 2- Shortage of technical professionals in the Contractor's organization.
- 3- Poor communications by the Contractor with the parties involved in the project.
- 4- Contractor's poor coordination with the parties involved in the project.
- 5- Slow processing of changed orders requested by the Client.
- 6- High Restrictions to Project Manager limits of authorities.
- 7- Delays in mobilization
- 8- Selection of unqualified sub Contractors
- 9- Poor management of subcontractor by Contractor
- 10- Poor implementation of HSE procedures and requirements within the Contractor's organization
- 11- Poor qualification of the Contractor's technical staff assigned to the project
- 12- Changes in the project organization chart throughout the project duration
- 13- Improper studies for the technical requirements of the Bidding documents by the Contractor during the bidding stage

- 14- Ineffective planning and scheduling of the project by the Contractor
- 15- Delays in the field survey by the Contractor
- 16- Ineffective control and monitoring of project progress by the Contractor
- 17 - Poor cost control throughout the project duration
- 18- Poor implantation of Quality Control Requirements
- 19- Delays in the preparation of the Contractor submissions
- 20- Poor documentation control
- 21- Improper construction methods implemented by the Contractor.

**Project finance:**

- 22- Difficulties in financing the project by  
the Contractor

- 23- Cash flow deficiency faced by the  
Contractor

**Causes of delay attributed to consultant:**

- 24- Poor qualification of the Consultant engineer's staff assigned to the  
project
- 25- Delay in the preparation of drawings
- 26- Delay in the approval of Contractor submissions by the Consultant
- 27- Poor communication between the Consultant engineer and the other  
parties involved in the project
- 28- Poor coordination by the Consultant engineer with other parties  
involved

- 29- Delay in performing inspection and testing by the Consultant engineer
- 30- Slow response from the Consultant engineer to Contractor inquiries
- 31- Poor contract management

**Causes of delay attributed to client:**

- 32- Delay in hand over the site to the Contractor by the Client
- 33- Delay in the settlement of Contractor claims by the Client
- 34- Delay in issuing of change orders by the Client
- 35- Delay of progress payments by the Client
- 37- Client's poor communication with the  
construction parties and the government authorities
- 38- Slow decision making by the Client's organization
- 39 -Excessive bureaucracy in the Client's administrations

**EARLY PLANNING AND DESIGN:**

- 40 - Original Contract duration is too short
- 41- Change in the scope of the project
- 42- Ambiguities , mistakes ,and inconsistencies in specifications and  
Drawings
- 43- Subsurface site conditions materially differing from the Contractor  
documents

**Causes of delay attributed to government regulations:**

- 44- Difficulties in obtaining work permits
- 45- Non stable government taxes policy

**Causes of delay attributed to external factors:**

- 46- Bad weather conditions on the job site
- 47- Effect of social and cultural conditions

48- Rise in the prices of materials

49- Effects of subsurface conditions (type of soil, utility lines , water table )

## **2.6 Construction Project Risks**

Construction risks can be defined as that factor that pose as threats and problems to the overall project completion and hinder 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)

### **2.6.1 The concept of risk**

The risk is the possibility of an adverse deviation from the expected outcome and that the main objective of risk management is to measure the risk in order to monitor and control) Tarek Hammad, 2003

(The risk imperative cannot be avoided in construction projects and Construction) Samuel 1996

(The risk as the likelihood of loss or profit resulting from uncertainty or uncertainty) rodger& Jason 1999

He said hulettvice 2001 (that each project is exposed to risks) illustrates one UN reports un-act-1998 that the risk is part of the personal and social life, including personal safety, health, accident and depreciation of assets and production, inflation and currency rate and other

(Risk of uncertainty on what the loss) Nasser Kikhya 2004 and George Rajadda2006

The construction projects and construction of a special nature and the most important features along the periods that may claim to change the conditions making it contain multiple risks.

As a result of the length of the implementation period and the multiplicity of stages, which leads to increased conditions of uncertainty and increasing the likelihood of risks, including a negative impact on construction contracting economies and Construction Even if were similar construction projects in terms of the nature of their composition, these projects are at different stages of implementation therefore it may be exposed to risks and those risks interact negatively with the cost and time of implementation of the project

Since the construction consists of a group's activities are related to acts of buildings and construction of all kinds in addition to the maintenance work of this sector is characterized by a close relationship with all other economic sectors, which make it important for the movement of national economic indicator

It risks faced by construction projects and Construction that affect the course of the project and which claim the result delay delivery and increase cost and sometimes poor quality, including:

- Leaders and observers and engineers implementation skills
- Financial factors (funding from the employer)

- Design change from time to time by the employer
- The central decision-making
- The quality of communications between the parties of the project bases
- Design flaws discovered during execution
- Climate factors.

It must take into account that Construction Industry risky suffered by the contractor and which are difficult to predict or avoided or their impact on the project.

(The owner of the interest of the economic work that is distributed or minimize risk and that the dimensions of sterile idea that the contractor bears all risks) Mustafa Shiha 1995

## **2.6.2 Risks associated with project construction delay:**

- **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.

- **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.

- **poor quality**



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).

Construction project success can be defined as the completion of a project within the estimated time, cost and quality.

Delay also cause the lack of quality required because the attempt to push the time and move activities forward, leading to the neglect of quality.

- **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, 2006) 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.

- **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 losses to the stakeholders. To the owner or client losses in terms of capital and other resources including time. To the contractors and consultants losses 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 300 billion Naira. In addition (Yap, 2013) stated that in 2000, there were about 54 abandoned housing projects in the country with an estimated value of RM7.5 billion.

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 stakeholders.

## **2.7 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.

## **CHAPTER THREE**

### **METHODOLOGY**

#### **3.1 Introduction**

This chapter comprises of the method and the design that was used to conduct the research. It was Gathering data and information from documents of projects, in addition to base on several factors of delay that was displayed at literature Review. The research methodology chosen for this study comprised of Analysis data and information collected from documents of project to identify factors that have emerged in the case study which led to the delay in the project, and explain responsibilities of these factors of delay and classification the type of delay based on Theoretical framework in literature and shorten all analysis result as in figure (3.1).

#### **3.2 Research Design**

The research was designed to get the data from the literature Review to identify the possible causes of delays at construction projects, and tested these causes with the analysis of the data and information was gathered from documents of project to explain the causes of delay that emerged during the implementation of the project. The possible causes, effects and risks of delays were identified from the literature, and these factors were tested with the analysis of the data and information of project. A total of 30 delay factors were identified from the literature in addition to 11 effects of construction projects delay were also identified from the literature, similarly, risks factors associated with construction projects delays were also identified.

The primary data from literature review and secondary data included reports, BOQ, photos; letters, figure (3.2), figure (3.3) below explain that.

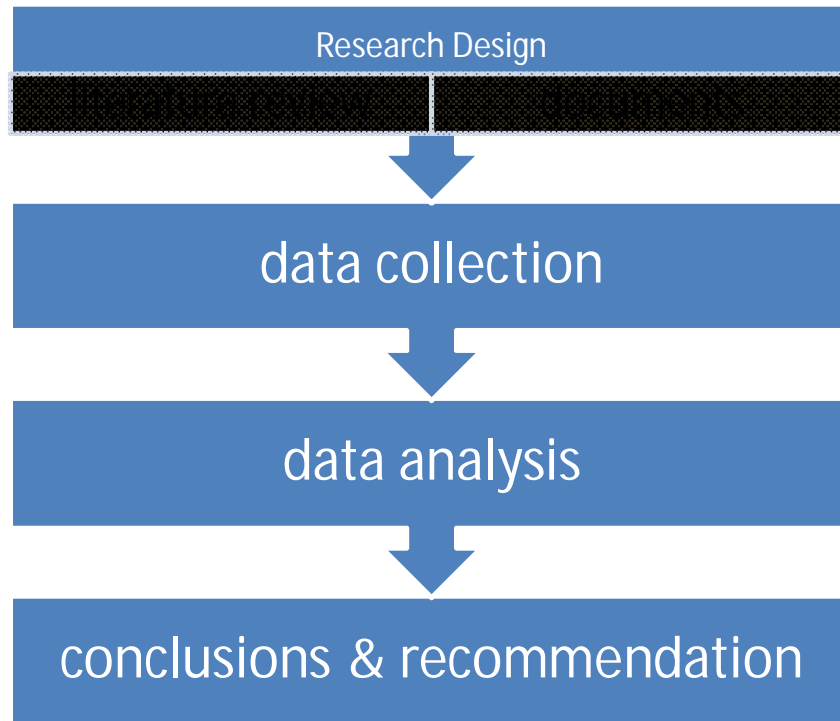


Fig. (3. 1) research design

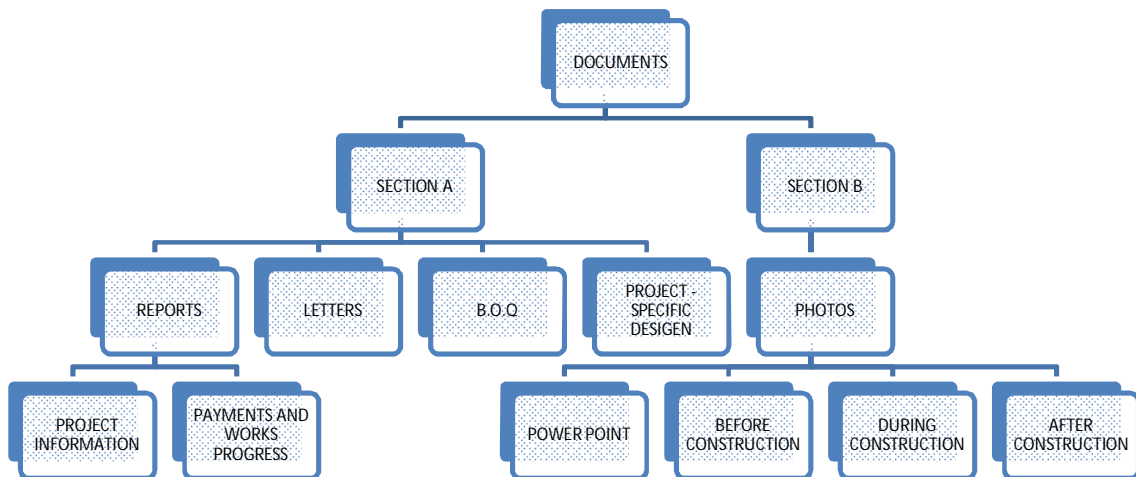


Fig. (3. 2) data collection

### **3.3 Geographical Scope**

The scope of this research is limited to the government projects in Khartoum and was taken the central market as case study.

### **3.4 Time scope**

The research was at the time period between Augusts to December 2016.

### **3.5 Research Techniques**

In this study the central market in Khartoum State was chosen as case study to represents the most of government's development projects, in addition to interviews with Consultants of project with over 15 years of experience in the construction industry, contractor of project, and clients to gather information, in addition to visits to site.

#### **3.5.1 Data Collection:**

This is referred to as the gathering or the collection of information from participants of the project to suitably answer the research objectives or give answers to other searchers. In this study, the data was obtained using different methods such as personal investigations, phone interview and site visit.

#### **3.5.2 Primary data collection**

The primary data refers to the information can be collected through direct personal investigations, the collection modes could also Be through; emails, personal interview, phone interview and visits. The advantages of this method of data collection include; reliability and accuracy, On the other hand, the disadvantages were high cost and too much time spent. In the case study the primary data was collected by through documents, site visiting, direct personal investigations, interviews with project participants, the client, contractor and consultant of project.

### **3.5.3 Secondary data collection**

The secondary data refers to that information which have already been collected, Analyzed, documented and published by some other researchers as previous studies, in addition to some papers and literature review, which brings out the main sources of the secondary data collection deals with the extant literature. In this study, our secondary data was collected from References and previous studies.

## CHAPTER FOUR

### RESULTS AND DISCUSSION

#### 4.1. Results

Based on the data and information which was collected from documents and literature review, These data will be analyzed and abbreviation results in the form below “figure 4.1” to explain causes of delay, who is responsible and type of delay in addition to discuss the effects, risks, and mitigating of delay.

##### 4.1.1 Delays in the delivery site:

Table (4. 1)the delivery site

Table (4. 1) the delivery site

Statement	Date	Delay Time
The contract signing	May 8, 2012	-
receipt of the site	July 08, 2 012	Tow months

From appendix (A.1.1)project information I found the results shown in table 4.1 above,

The delivery site after two months from the contract signing date, client delayed the delivery site two months, this delay may cause losses to the contractor, because the delivery of the linked purchase and supply of materials site, and thus delay means delays in purchasing materials may increase with the delay and According to the law of Fedics

Contractor may be required to compensate in the event of a loss. In (figure 4.2) explained the cause, responsible and type of delay



#### 4.1.2 Delay in payment to contractors:

Monetary rewards will result in 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.

From the appendix ( A.1.1) project information the contract signing date in May 8, 2012, receipt of the site in July 08, 2012, The completion of the implementation October 18, 2012 and that explain the work progress of project as contract, as found in appendix( A.2.1) in official letters there is a letter from consultant of project shows that the actual beginning of the project on August 2012 based on payment of 20%, figure(4.3 )Explain that.

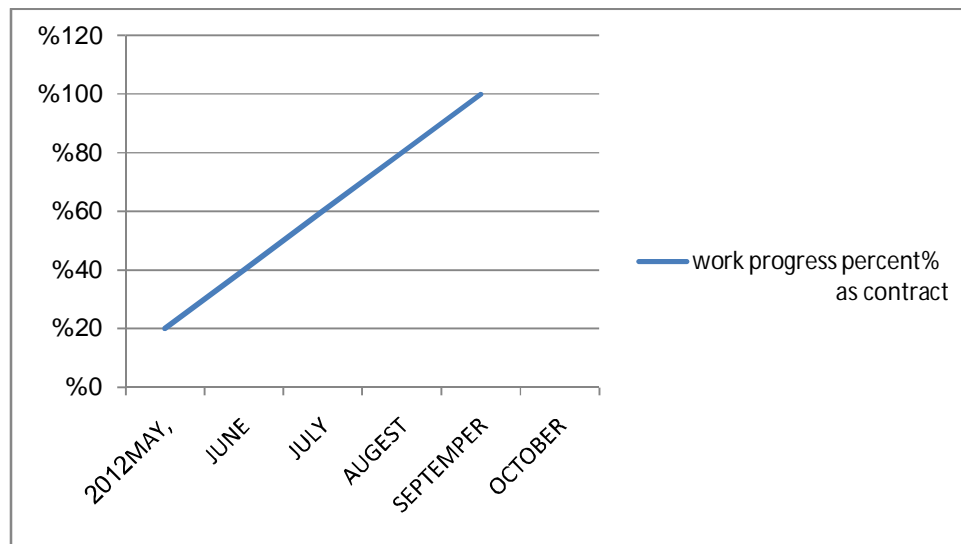


Fig. (4. 1) work progress of project as contract

From appendix (A.1.2.2) at Periodic Report, the figure Work progresses, matching the implementation with schedule agenda, In May and June, the site has been equipped by the owner, and this time out of the schedule to the contractor and the actual beginning of the project on August 2012 as shown in appendix (A.2.1), then Stops working after two month from actual beginning

date of the project at September, 2012 Until January 2013 As shown in figure (4.4) Below:

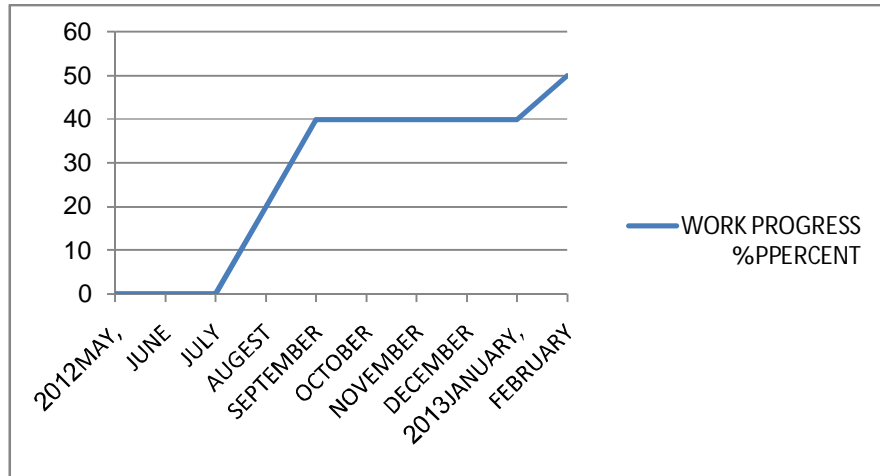


Fig. (4. 2) work progress as the work progress reports

In addition to an appendix (A.1.2.3) at Work progresses, Referred to by the project consultant, that delaying action as a result of the delay in payments.

From official letters it shows that there were claims from the contractor to increase prices that from appendix( A.2.2) to appendix (A.2.4) Where the dollar exchange rates and customs explained, which indicates the presence of increased as a result of the delay in payments from the owner and the contractor demanded increases approved by the project consultant as in appendix( A.2.5) date October, 2012 at stop work period, Thus, we find that a delay in payments led to a work stoppage four-month period as well as the demand increases which indicates that the delay was due to the owner and the necessary compensation, figure( 4.5) show the cause , responsibility and type of delay as result of analysis.

#### 4.1.3 Funding problems

Funding problems appear as a result of lack of good planning for the project, In this case study we note the presence of the problem of financing as a result of poor planning because the funding from the Bank of the Nile after 13 months

from the contract signing date and that is through Display data appendix( A.1.2.1)Where a contract date of Nile bank for trade and development at June 19, 2013 and The date of the end of the decade for a contract of Nile Bank at November 19, 2013Accordingly, it was scheduled completion ofthe implementation date on December 31, 2013 ,In other words, Finance from the Bank of the Nile after eleven months from the contract signing date And for a period of June to December, 2013as shown in figure( 4.6).

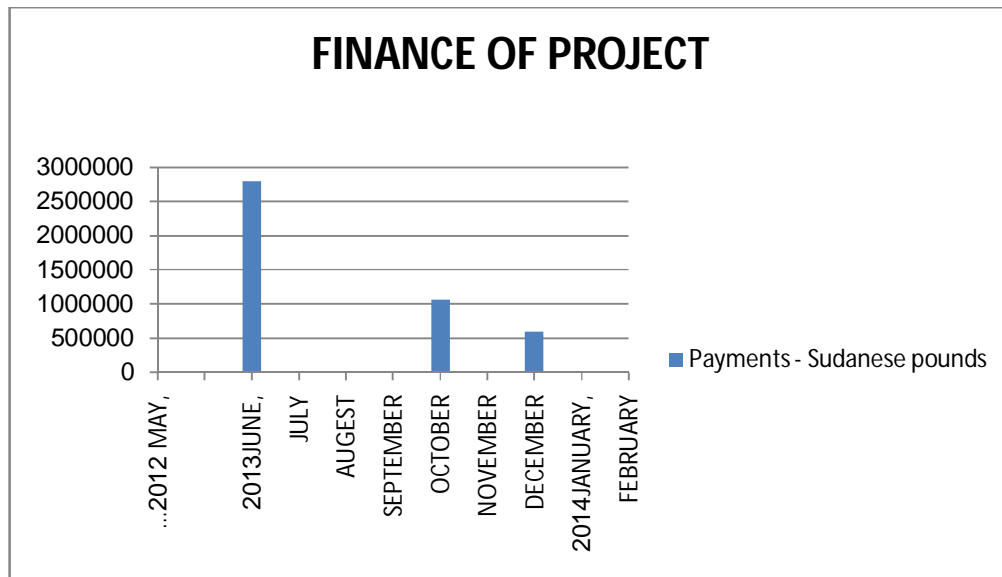


Fig. (4. 3) financing of the project period after 11 months from contract Signing date

Since the owner is responsible for providing funding for the project Figure (4.7) explain the cause, responsibility, and type of delay in funding

Study the financing of the project is an important stage before starting the contracting phase, because the funding ensures the provision of payments leading to ensure the continuation of work and not to delay the project, But in the case study, we find that the use of funding by the owner after the contractor had stopped working, and the inability of the owner to provide payments

#### 4.1.4 Design changes

Constant changes of the project design will mean constant changes in the projects Plan, Once the design is changed, it will take some more time to come out with a new design specially if the change during implementation, This changes made will consequently delay the project, In our case study through the presentation of project data and site visit and interviews with participants in the project we found that the design change Included the following themes as in figure (4.8) below.

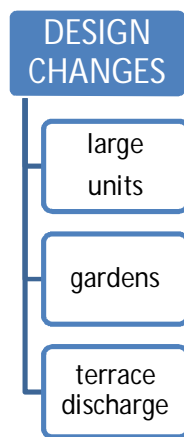


Fig. (4. 4) design changes

##### 4.1.4.1 Large units

From appendix section “B”, Through the display of PowerPoint of project there are some changes at design of large units of project Compared to what has been implemented at the site Apparently at the display in appendix( B3 )“photos during construction” where images show that what has been implemented does not match with the initial design and the modification in the design was during execution, Where modification of the window width of 2 meters and a width of 1 meter door to door only a width of 2 meters As it is shown in appendix (B.1.8) power point and appendix from (B.3.1) to appendix( B.3.10) explain Which has been implemented .

#### **4.1.4.2 Gardens**

in appendix section “A” appendix ( A.4.1.1)Gardens appear in the design in the middle of the market and in the northern side, WhileFrom an interview with the project consultant found that it had been canceled gardens,this is appear in appendix from (B.3.20) to appendix( B.3.22 )at photos during construction and The number of gardens was two,the reason for cancellation based on the opinion of the project consultant is due to incompatibility with the nature of the project, and the design was by owner.

#### **4.1.4.3 Terrace discharge**

It appeared in the designIn the West End in appendix (A.4.1.1) and Have been modified to the south instead of the West BankI found that When I visited site and the cause of design change is toproximity to the entrance to the market in addition to the presence of the well and the septic tank of the West End, this is a project consultant opinion.

While The Design by owner “the Department of Project Management in Khartoum Locality”, figure (4.9) shows the responsible, cause and type of delay.

The implementation phase of the contract in the absence of people with experience of contract, in addition to the Lack of good study for the project in the preparation of project documentation phase that leads to design changes.

#### **4.1.5 Fluctuation of prices of construction materials**

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 clients is not able to raise more money, the Project is bound to be delayed,Based on what has been said, we find that the increase in contractor prices due to rising dollar and the price of the customs, which was submitted by the contractor in September 2012Note that

the submission of price increases by the contractor in September, a month in which the contractor stopped work for four months period , and the project contractor refused Advisory increase, as shown in the appendix from( A.2.2) to (A.2.5).

Price increases linked to a delay of payments by the owner, Figure 4.10 explain the cause, responsibility, type of delay in fluctuation prices.

From this display the owner causes delay at payments which led to fluctuation prices and that led to claims and delay in project, figure( 4.11)explain result of fluctuation prices at project.

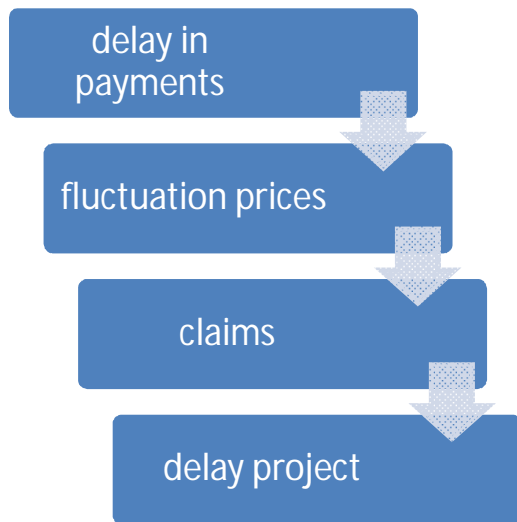


Fig. (4. 5) fluctuation prices

#### **4.1.6 contractorsSelective:**

In this case study, we find that the government is the owner of the project, represented in Khartoum Locality.

government intervention appear through some contracts for some additional work on the project, where we find that some of the subcontractors are not commensurate their experience and competence with the size of the project, which indicates the presence of administrative corruption, and through the granting of these contracts, Also appeared in the progress report some of the

sub-contractors are individuals not companies, their experience and abilities are not commensurate with the size of the project such as “zakariamubark, alkendi” As shown in the payments reports appendix ( A.1.2.5) ,where has beenAwarded contracts for the implementation of small units of iron, in addition to a number of shops as appeared in appendix from (B.4.79 )to figure ( B.4.81), and connect the power cable.

Since the government is the owner, this means that the owner is responsible for the delay, figure (4.12) explain cause, responsible, type of delay. The awarding of contracts to contractors are not qualified, leading to complete the work incorrectly, in addition to the re-implementation of the works as result of mistakes, each leading to project delays.

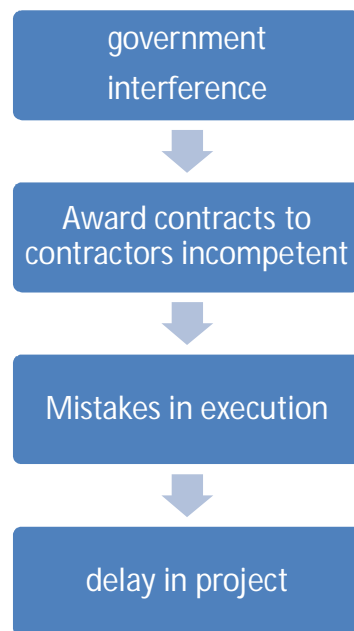


Fig. (4. 6) government interference

#### **4.1.7 IncompleteDesign**

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

In this case study we find that in the design phase the absence of the entire design of the project with all its services which led to increasing the number of contractors in the project, overlapping works and delaying the timetable for the project, that appeared in the appendix ( A.3.1),( A .3.2 )“ BOQ” in addition to appendix (A.1.2.2) “ project description”

In appendix (A.1.2.5) We find that the basic contract includes units sales and administration building only, while the additional works included more than six subcontractors We also find that the cost of basic contract about 11 billion, while the cost of additional contracts is approximately 9 billion and The cost indicate the volume of works, the Additional works Represented in the following works as it was mentioned in appendix( A.1.2.5) “PERIODIC REPORTS” in addition to appendix( B.3) and figure (B.4) photos during and after construction:

- Water works
- Sewage works
- Electricity acts and cables
- Acts of ablution facilities
- Umbrellas lanes
- Reinforced concrete for flooring
- Rain drainage pipes
- Works of doors of the administration building
- Umbrellas for women

We find that the additional works ratio of about 43% of the total cost of the project, It was represented in the form below figure (4.15).



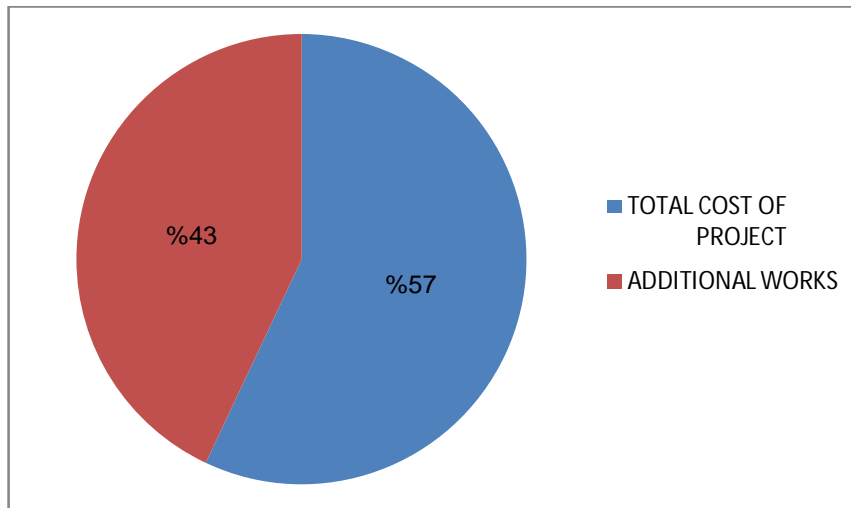


Fig. (4. 7) the additional works ratio of total cost

The large number of additional works led to overlap works and frequent mistakes during implementation, in addition to the emergence of problems between subcontractors thereby delaying work on the project, figure (4.16) bellow explain cause, responsible, type of delay

Since the cost of additional works almost half of the total cost of project, this indicates a Non-completion of the design optimally by owner which led to a lot of additional works,

#### **4.1.8 Low standard design**

Specifications are an integral part of the design phase, we find in the case study that the specifications are very weak, as the specifications of the project has been limited to two pages only, Which led to the emergence of a lot of problems As a result of adjustments in work among the participants in the project as in appendix( A.1.2.3) “Modification doors and columns”, that led to stop work by the project consultant in many phases of the project, figure( 4.17 ) explain cause, responsible, type of delay

Since the design was by the owner, this means the responsibility of the owner of the errors resulting from the weakness of specifications thus delaying work on the project all of which led to a delay in work on the project.

#### **4.1.9 Rework due to errors**

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, In the case study there are a lot of works that have been returned as a result of mistakes in the implementation, such as works of plasters, interior paints, installing walls cork for units, Expansion Joints, works of doors, Terraces discharge, Floors As it is seen through appendix( B.3, B.4 ) at photos, and periodic report appendix (A.1.2.3), (A.1.2.5) Where reference was made to the work of the doors , windows, roofs paints.

The results indicate that the Contractor responsible for technical errors, figure 4.18 below explain the responsibility of reworks due to errors.

#### **4.1.10 inadequate contractor's experience**

The main contractor for the project, the European modern factory, it is a new factory, manufactures and sells panels of cork, Based on what has been obtained from the information on the practical experience of the contractor, we find that the project “the case study” is the first project by the contractor executed in the state of Khartoum, where practical experience in the implementation of some small units, which are used as offices guarded "caravans" , in addition to , We find that for the emergence of a lot of technical problems the project consultant request from the contractor to provide Disciplines, responsibilities, qualifications for his team as in appendix( A.2.1) “official letters”.

The technical problems as plaster works Where the work was performed manually rather than automatically by “kimbersor” , Flatwork

tendencies, Expansion Joints ,And other works that have been modified until the end of the project as the project consultant's report in appendix( A.1.2.3).

We find that all the technical errors the Contractor delays in the work of the amendments as shown in the project consultant's reports, appendix from (A.1.2.3) to appendix( A.1.2.5) at Paragraph work progresses, And appears in the project consultant reports some of the work of the proportion of the amendments accomplish, and by reference to the date of preparation of this report, we find that the completion of the amendment and approved at the end of the project after twenty-two months from actual beginning of the project, and this shows that the delay in the work of the amendments by the Contractor figure (4.20 ) Explain cause, responsibility, and type as a result, figure 4.19 below explain the percentage of completion and the date of its adoption

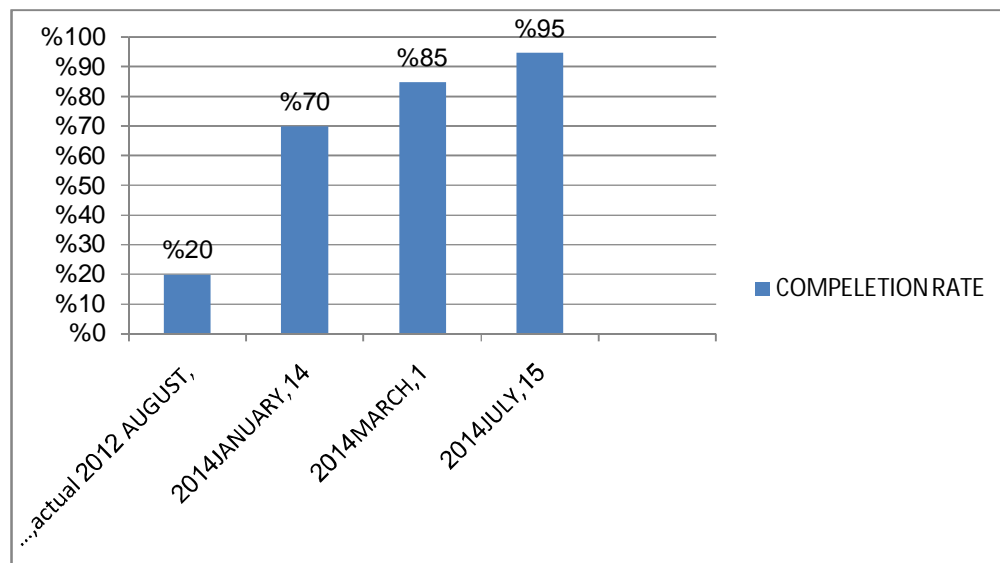


Fig. (4. 8) the Percentage of Completion and Date of Its Adoption

The owner has the responsibility of choosing the contractor, in the absence of sufficient experience for the contractor to be shared responsibility and the delay type Excusable non-compensable delay Depending on the classification in chapter two at literature review.

#### 4.1.11 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, the project consultant must oblige the contractor to abide by the timetable, but in the case study, we find that the problems of payments by the owner prevented the consultant to oblige the contractor.

While The completion of the implementation October 18, 2012” the timetable for implementation of the project 130 days” As it stated in the report of the consultant at appendix( A.1.1), the project was delivered on June 25, 2014 that means The percentage of delay  $82.6\% (23-4/23 \times 100)$  , appendix( A.1.2.5) , table 4.2 explain that.

Table (4. 2) the timetable for implementation and the delay

The completion of the implementation According to the contract	October 18, 2012	-
The actual completion of the implementation	July 25 , 2 014	Twenty-one months

As we have found from an earlier analysis that the reason for the delay and stop work is payments from the owner, Delay in payments from the owner who is responsible, this impact indirectly on the project time Figure( 4.21) explain that.

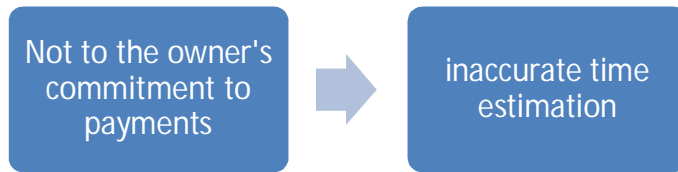


Fig. (4. 9) inaccurate time estimation As a result of the delay in payments

In addition to Failure to manage the work by the contractor according to the contract schedule; figure (4.22) explains cause, responsibility, type of delay in inaccurate time estimation.

#### **4.1.12 Inaccurate cost estimation**

A review of the project consultant to the cost and specifications provided by the contractors of the project is an important stage in the project planning, but in the case study, we find that the project management in a local Khartoum was the designer and consultant for a period of up to two months from the beginning of the implementation phase, and then was hired Advisory "Turbo reconstruction," where he was a consultant of the project after the owner, Here we find that the project consultant came after contracting stage In other words, Project consultant contract to oversee the implementation.

At the case study the contract was measurement, the Basic contract was 11,164,527.89 SDG, the value of the basic contract at the end of the project was 11,986,072.01 and the value of the total cost of the project was 21,172,663.45 SDG Result of additional works, where the additional works value was 9,186,591.44 figure (4.23) show that.

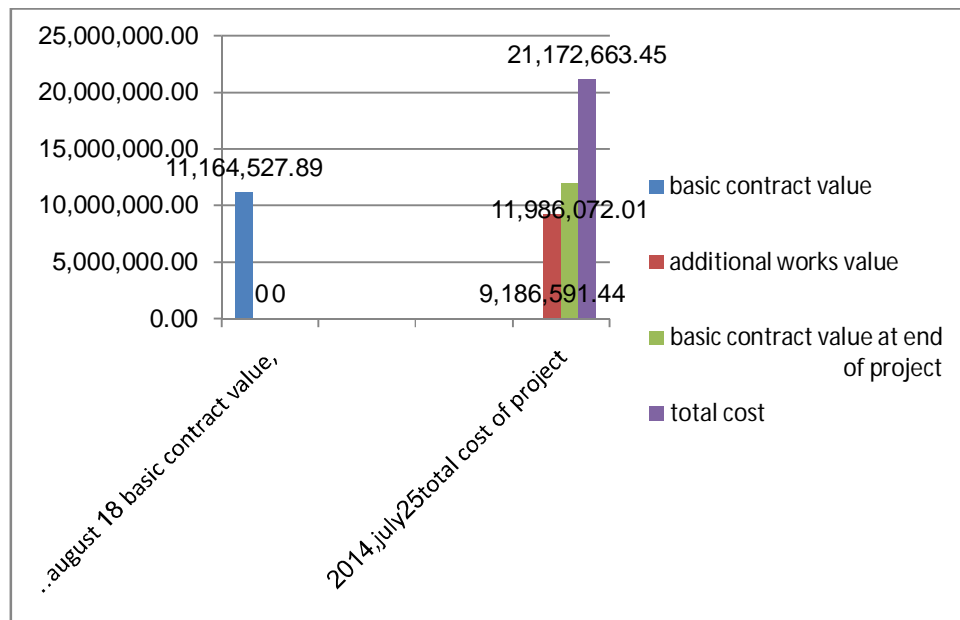


Fig. (4. 10) total cost of project

The percentage of an increase at total cost of project 52.7% ( $11,164,527.89 / 21,172,663.45$ ) figure (4.24) shows that.

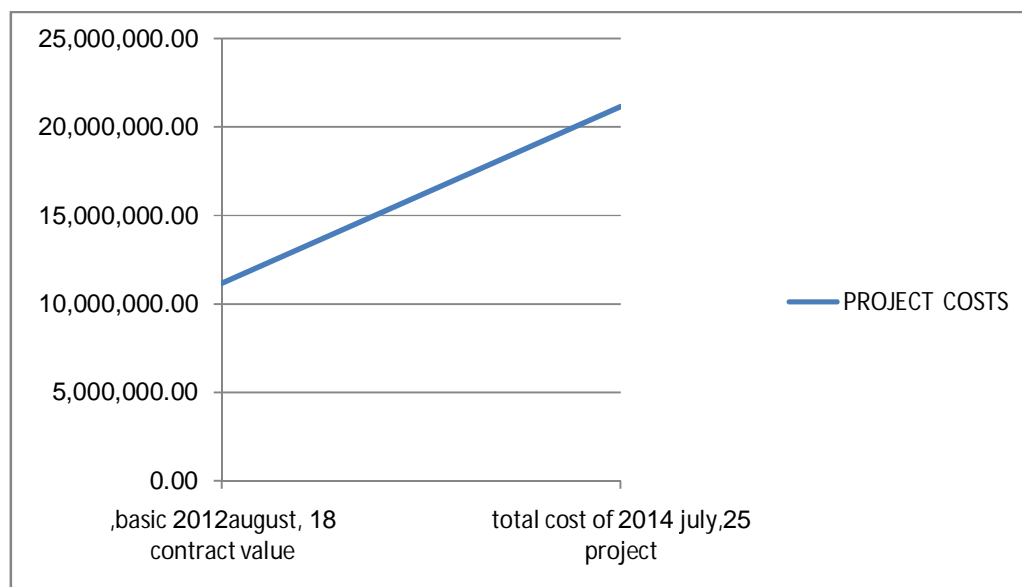


Fig. (4. 11) the increase in cost of project

This high cost of the project led to the lack of the owner's commitment to payments, Since the contracting stage was the responsibility of the owner, this means that the owner is responsible for the increase in the cost of the project,

figure (4.25) explain cause, responsibility, type of delay in inaccurate cost estimation

#### **4.1.13 Shortage of materials**

If the materials needed to carry out the project to construction are limited, it will cause the project to be delayed. In the case study of the contractor demanded to amend the Price, was the work of a study by the project consultant, and note that the increase included flooring, doors, windows, walls, ceiling, and electricity, Delay payments led to claims by the contractor as a result of increasing the price of the dollar, customs and thus prices of materials, and the consequent delay in the time of the project. As shown in appendix from (A.2.2) to (A.2.5). The owner is responsible for the delay figure (4.25) explain cause, responsibility, type of delay.

#### **Summary of study**

The percentage of some reasons for the delay

##### **1. Delays in the delivery site**

2/4.3=46%

##### **2. Delay in payment**

Work stopped due to the delay in payment, design changes, fluctuation of prices four months

4/4.3=93%

##### **3. Work stopped by owner due to Lack of commitment by the contractor for a month**

1/4.3=23%

##### **4. Design incomplete**

- Most of the additional works were completed by 75% or more on January 2014.

The first payment to the last contractor in the additional works dated August 2013 as the date of the beginning of last additional work, we find that the delay of five months and the Completion rate has reached 85% in July 2014

$$11/4.3=259\%$$

#### **5. the total percentage of the delay from above causes**

$$421\%$$

#### **6. The percentage of total delay at project**

The timetable for implementation of the project at contract 130 days “4.3 months” The total actual time of the implementation of the project 23 months

$$19/4.3=441\%$$

- The owner caused the delay from above causes by 398%

**Result:**

**Owner is the main responsible of delay**

#### **The percentage of an increase at total cost of project**

The basic value of the contract=**11,986,072.01**

The value of the work done in the project= **21,172,663.45**

The percentage of an increase at cost=176%

Table (4. 3) Table of results

<b>Cause</b>	<b>Responsibility</b>	<b>Type</b>
Delays in the delivery site	client	excusable / compensable
Delay in payment to contractors	client	excusable / compensable
funding problems	client	excusable / compensable
design changes	client	excusable / compensable



fluctuation prices	client	excusable / compensable
government interference	client	excusable / compensable
design incomplete	client	excusable / compensable
low standard design	client	excusable/ compensable
reworks due to errors	contractor	non excusable
inadequate contractor's experience	contractor/client	Excusable non-compensable delay
inaccurate time estimation	client/contract	Excusable non- compensable
inaccurate cost estimation	client	excusable compensable
Shortage of materials	client	excusable compensable

## **CHAPTER FIVE**

### **CONCLUSION AND RECOMMENDATIONS**

#### **5.1 Recommendations**

Building construction delay is an unavoidable event 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

This may be due to lack of in adequate financial resources to successfully complete projects on time, In addition it could also be due to lack of technical expertise, poor construction skills.

Government projects seen as an axis for corruption which can also answer the question why delay in construction is mostly common in these types of project, another very clear reason could be the shortage of material supplies since most developing 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 developing 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 excise duties.

- The government in collaboration with other stakeholders should invest heavily in human capital development by training construction workers with the right technical skills for National employment rather than foreign 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.

Finally 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 data and information size was also small, Depending on the nature of the sensitive project, where, the government client, so I hope at future researchers could take a bigger data and information size in order to produce a more valid results. 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 provide the data used in similar projects and reduce the chances of delay at projects.

## **5.2 Conclusion**

The consequences of delay at building construction projects are always negative, thus 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 IF 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 main cause of projects delay was delay in payment to contractors and most common causes of construction project delays were, Design incomplete, design changes, Funding problems, fluctuation of prices of construction materials, shortage of materials, inadequate contractor's experience, Government interference, shortage of materials, inaccurate time estimation, Low standard design, Reworks due to construction, and inaccurate cost estimation.

In addition the most common effects of construction delays were proven to be; Cost overrun, time overrun, disputes amongst project participants and negative social impacts and litigation.

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 finally the most effective measures of mitigation delays in construction were; Information sharing, Total Quality Management (TQC), Joint risk management, continuous trainings and early follow up and involvement of contractor and subcontractors.

From the data 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 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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## Appendix B.3PHOTOS FROM THE SITE DURING CONSTRUCTION

صور توضح اعمال البياض الخارجي والابواب

**Appendix B.3.1**



**Appendix B.3.2**



**Appendix B.3.3**



**Appendix B.3.4**



**Appendix B.3.5**



**Appendix B.3.6**



## Appendix B.4 Photos from the site after the building process

صور توضح اعمال الدهانات الخارجية والمظلات

Appendix B.4.1



Appendix B.4.2



Appendix B.4.3



Appendix B .4.4



Appendix B.4.5



Appendix B.4.5



صور توضح اعمال الدهانات الداخلية

## Appendix B 5.1





## صور توضح وحدات البيع الصغيرة

**Appendix B.6.1**



**Appendix B.6.2**



**Appendix B.6.3**



**Appendix B.6.4**



**Appendix B.6.5**



## صور توضح مدرجات البيع

## Appendix B.7.1



صور توضیح مبنى الإدارة

**Appendix B.8.1**



**Appendix B.8.2**



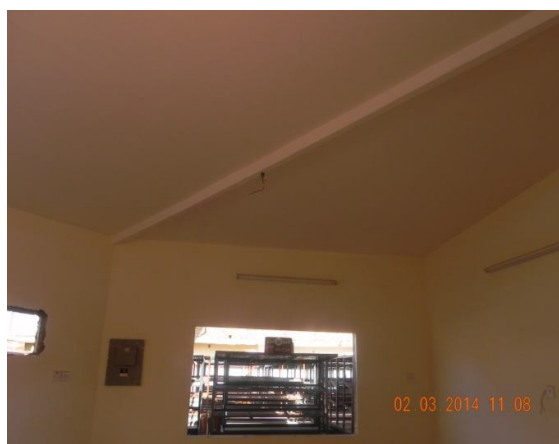
**Appendix B.8.3**



**Appendix B.8.4**



**Appendix B.8.5**



**FIGURE B.8.6**



**Appendix B.8.7**



**Appendix B.8.8**

