PROJECT PERFORMANCE AND DELAYS IN SUDAN CONSTRUCTION INDUSTRY

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2009

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The submitted in fulfillment of the requirements for the degree of Master of Science

September 2009

ACKNOWLEDGEMENTS

I would like to make an acknowledgement to those people who helped me to complete my thesis. Without their help, the completion of my master degree would not have been possible. I would like to express my special gratitude and remain ever in debt to my parents, who mad faithful supplication (Dua'a) to Allah for my success. I wish to express my profound gratitude appreciation and thanks to my Aunt, who stood by me since my childhood and gave me the necessary training i deserve. Special appreciation is extended to all my sisters for their continuous support. Respectfully, I dedicate my thesis to them.

I want to acknowledge my project supervisor, teacher, and mentor Dr. Abd Hamid Kadir Pakir for his effort, and encouragement to complete this research. I am grateful for him for his guidance in the entire course of my studies. I also want thanks are extended to Dr. Abdelnaser Omran Ali for his assistance and supervisory role throw out period of this research. Finally, I wish to thank my friend Ahmed Mohammed Kamaruddeen for his support and advice.

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LIST OF ABBREVIATION

CIDB	Construction Industry Development Board
JCT	Joint Contract Tribunal
OHS	Occupational Health Safety
SPE	Safety Performance Evaluation
SER	Sudan Economic Report
SPSS	Statistical Package for the Social Sciences
TQM	Total Quality Management
IPMA	International Project Management Association

KELEWATAN DAN PRESTASI PROJEK DALAM INDUSTRI BINAAN DI SUDAN

ABSTRAK

Industri pembinaan di Sudan menghadapi berbagai masalah dan cabaran seperti, pencapaian projek yang rendah dan penangguhan penyelesaiaan projek. Kajian ini hendak mengenalpasti faktor-faktor tersebut bagi meningkatkan pencapaian projek, selain itu faktor-faktor yang menyebabkan penangguhan projek pembinaan di Sudan. Banyak kajian literature terdahulu yang telah di kenal pasti bagi memperolehi maklumat berkaitan dengan faktor-faktor yang mempengaruhi pencapaiaan projek dan faktor-faktor yang menyebabkan penangguhan projek. Daripadanya 41 faktor bagi pencapaian projek dan 10 faktor yang menyebabkan kepada penagguhan projek. Sebanyak 70 borang soal selidik berstruktur telah disebarkan secara rawak. Untuk memperolehi data yang diperlukan bagi mengenalpasti faktor-faktor yang paling utama, 52 set borang soal selidik yang telah di jawab diperolehi dari responden. Responden terdiri dari 19 perunding, 20 pemaju, dan 13 orang pengurus projek dari sektor swasta. Indeks Kepenting Relatif (RII) telahpun digunakan bagi menentukan kedudukan faktor-faktor yang mempeneruhi pencapaiaan projek dan sebab-sebab penangguhan sesebuah projek. *Spearman's Correlation Coefficient* menunjukkan kekuatan hubungan antara setiap faktor-faktor utama. Sementara tes *Kruskal-Wallis* menyatakan wujudnya perbandingan dan perbezaan pandangan antara kumpulan yang terlibat (pengurus projek, pemaju dan perunding) berkaitan dengan kepentingan relatif dari setiap pembolehubah. Hasil kajian mendapati bahawa terdapat 5 faktor yang paling penting mempengaruhi pencapaiaan projek iaitu; pengalaman pemimpin kumpulan projek, upaya perancangan, kecukupan rekabentuk dan spesifikasi, kos pemantauan pelaksanaan dan kemahiran kepimpinan seorang pemimpin. Tambahan

juga, didapati bahawa faktor yang paling penting yang menyebabkan penangguhan projek adalah perancangan pemaju yang tidak baik, pengalaman pemaju yang tidak cukup, kewangan dan bayaran pelanggan, kesalahan selama pembinaan dan kurangnya komunikasi antara pihak-pihak yang terlibat.

PROJECT PERFORMANCE AND DELAYS IN SUDAN CONSTRUCTION INDUSTRY

ABSTRACT

The construction industry in Sudan is facing several problems and challenges such as poor performance of projects and delay in completion of construction projects. This research seeks to identify those factors that enhance performance of the projects, as well as the factors that lead to the delay of projects in Sudan. A substantial literature review was done to obtain the information on factors that influence project performance and factors that cause the construction delay from previous researchers, from which forty one factors were identified for project performance and ten factors that cause delay. A total of 70 designed structured questionnaires were distributed to construction firms in Khartoum and 52 questionnaires were completed and returned. The Relative Importance Index (RII) was used to rank the factors that influence project performance and causes of delay. The Spearman's Correlation Coefficient, showed the strength of relation between the most important factors. While, the Kruskal-Wallis test shows that there was differences in opinions between the groups on the relative importance of the variables. The results revealed that the most important five factors that influence project performance were project team leader experience, planning effort, adequacy of design and specification, cost progress monitoring and leadership skill of leader. In addition, the result found the most factors that cause construction delays were improper planning by contractor, inadequate contractors experience, client's finance and payments, mistakes during the construction and lack of communication between parties.

CHAPTER ONE

INTRODUCTION

1.1 Introduction

Construction is a process of erecting buildings or structures that are inseparable with their location. The results of construction activities are such as building construction, road, bridge, railway, tunnel subway, airport building, and dams. These activities include planning, preparation, execution, demolition, and repairing building and other constructions.

The construction industry is one of the major driving industries in the world economy (Chinowsky and Meredith, 2000). It is also sometimes referred to as an engine for growth (Abu Bakar, 2002). Construction activities constitute an index of the economic and social progress of a country (Ogunlana, 2003). The construction industry generally represents a significant share of the total economic activity of a country with corresponding demand of materials, services and labour inputs.

In the development of any country, the construction industry plays a vital role in transforming the aspirations and the needs of its people into reality by implementing various physical structures (Ahmed, 2002). The construction sector is widely regarded as a catalyst for growth. It often serves as an indicator of economic performance of a nation i.e. brisk construction activities show a booming economy, whereas sluggish construction activities translate to a period of economic depression (CIDB, 2004).

The construction industry plays an important role in the national development of any nation. Its contribution to the gross domestic product of a country, particularly in developing countries, has always been acknowledged (Abu Bakar, 2002). In most developing countries, the state of the construction industry is in its infancy stage as there is lack of sophisticated technologies, professional and managerial skills, and the capital needed for construction projects.

In addition, another weakness faced by this industry is the poor understanding and process of project management. Effective project management techniques are important to ensure successful project performance. A poor strategy or incorrect budget or schedule forecasting can easily turn an expected profit into loss. This is especially true for the construction industry where projects have relatively short life cycle and the project activities are non-repetitive with rather complex interrelationship, so that there is little opportunity to improve a wrong strategy.

Generally, project management is the process of planning, allocating, directing, and controlling company resources to complete a project on time, within budget, and in accordance with the specified safety, technical and quality requirement. By the definition given, the function of project management are to plan, organize, co-ordinate , monitor and control activities and resources and to make appropriate decision in such a way that are directed towards the accomplishment of clearly defined major objectives. Project management, therefore, is the tool or mechanism used to develop a system 'from its

conception to realization. It consists of the organization, policies, procedures, information, methods, systems and practices used to initiate and implement the projects.

The most common constraints in the construction industry in developing countries are the oversupply of unskilled labour with a limited supply of management manpower. According to Abu Bakar (2002) what is vital in management is the availability of a manager who is able to manage risk that occurs in construction sectors. It is important to emphasize that upgrading the management capability is vital for growth and expansion in the construction industry. The appointment of the best project team will ensure the success of the project as well. However, a good leader, who is the project manager, must lead the best project team. The assignment of single project manager responsible for all aspects of a project has been recognized as a critical factor in the success of any design or construction project (Anderson and Tucker, 1994; Goodwin, 1993).

The project manager would ensure that the right people and equipments, of the right quality, in the most economical way, perform all the required work to complete a project in the correct order, at the right time, and in a safe and environmentally acceptable manner. In short, a good project manager can theoretically improve project construction performance.

A research done by Rowlinson (1998) specified that project participants, project procedures, human aspects and environment may affect project

performance. These factors may be contributed from different parties who are involved in the construction project, and each of them will play their individual roles in the success of a project. The team in a construction project is normally formed by the client, design professionals which consist of architects, civil and structural engineers, and construction professionals. The latter group is constituted by the main contractors and sub-contractors, suppliers and surveyor. The construction industry generally represents a significant share of the total economic activity of a country with corresponding demand of materials, services and labour inputs.

1.2 Sudan construction industry in general

1.2.1 Economic sector

Sudan's economy has registered an overall mixed economic performance in 2007. Continuous flow of petrodollars with many positive spillovers on other sectors of the economy, and the ensuing growing liquidity at hand enabling business volumes to increase in certain sectors of activity, were somehow offset by a drop in investments which resulted in a slowdown in non-oil activities. The economy is estimated to have registered an overall real GDP growth rate of 10.5% in 2007 as per the latest Central Bank Statistics (SER, 2007).

1.2.2 Construction industry sector

The construction industry has been thriving in recent times. Although it accounted for only 6.7% of GDP in 2007, it continued to drive economic activities, growing by a healthy 11% last year. The largest ongoing infrastructural project is still the US$2 billion Merowe Dam on the Nile,

founded mainly using Chinese capital. The 67-meter high and 9.2-kilometer long dam will create a 12 billion cubic meter water reservoir. The project has consumed so far 22 million cubic meters of materials. In relation to this, more than 1,000 kilometers of highways have been developed and 7,000 people have been working on it (SER, 2007).

The two largest dams on the Blue Nile, the Rosaries, and the Sennar are also being upgraded and five new bridges are under construction, including three around Khartoum. Simultaneously, a US$45 million building program for 450 kilometers of roads, including a ring road for the capital, is underway in Khartoum state. In addition, Khartoum is building a new international airport for US$1.3 billion just outside the city. Between 2007 and 2013, Khartoum is expected to witness the delivery of almost 11,000 apartment and villa units, as projected by Colliers International, a real estate service firm. Residential provision will be concentrated in three main areas of Khartoum especially Alsunut's Almogran. However, most of these units target the higher- income segment in the city leaving a gap at the level of the middle-income segment of market, not to mention the complete omission of a sizeable lower income category (SER, 2007). Sudan is undergoing great social and economic transformation; this requires the expended implementation of major plans for development in different sectors, including construction projects.

1.3 Problem statement

Successful construction industry plays an important role in the country's development. For the past few years, the construction industry have developed in size, complexity, and high demand by clients. This has resulted in construction projects becoming more difficult for the project objective of time, cost, and quality to be achieved. The level of success in carrying out construction and development will depend heavily on clarity of project objectives, detailed specifications of plan and a good schedule, client consultation and involvement, and effective monitoring and controlling of the project. Although there are guidelines for monitoring and controlling of construction project success, there are construction companies that face problem in completing the project according to project goals.

Client, consultant, and contractor are parties that are involved in a project development. Client initiates a project development, project consultant provides professional services of designing, surveying, testing and consultation and construction professional will build materialize the project. A good relationship and interaction among all parties in the construction industry is important in order to achieve successful project performance in the construction industry.

During the past three decades, records showed that delays and cost overruns are common in the construction projects. Morris et al (1989) evaluated the records of more than 4,000 projects between 1959 and 1986 and concluded that the success rate of projects is generally poor. He further emphasized that there are

very few records showing under runs. Delays have occurred in most types of projects, from simple building projects to the most complex projects.

Project performance in Sudan is influenced by many factors. The problem of cash flow is that it influence the performance because the contractor requires payments upon interim valuation and pay suppliers for materials supplied to the site. Lack of experience also affects the performance of project manager in the Sudan construction industry. Labour strike is a situation that needs proper management by a project manager. Industrial actions influence on the progress of work which in long run affects the performance of the project. The project manager also depends on the inputs of consultant teams. In the case of Sudan, unqualified consultant means that the project manager is not getting the right information at the right time. This study will emphasis on poor performance in terms of extensive delay.

An unsuccessful construction project can be caused by improper close out procedures. All contract works were not satisfactorily completed, outstanding claims were not resolved, change orders were not fully negotiated and processed, extensions of time reports were not approved, operations and maintenance manuals were not approved, as built drawings were not completed, and all other contract goals were not achieved. Therefore, this research will serve as a guide for clients, project managers, contractors, and consultants to avoid failures within the construction industry in Sudan.

1.4 Research questions:

1. What is the situation of project performance in the construction industry in Sudan?
2. What are the most important factors that influence project performance in Sudan construction industry?
3. What are the most important factors that are responsible for delay of projects in the construction industry in Sudan?

1.5 Research objectives

1. To investigate the situation of project performance in Sudan construction industry.
2. To determine the most important factors that influence project performance in Sudan construction industry.
3. To identify the most important factors that could cause construction project delay in Sudan.

1.6 Significance of the study

The construction industry is dynamic in nature due to the increasing uncertainties in technology, budgets, and development processes. A project is considered to be successful when such project is completed within the stipulated and agreed contract period, cost limit, while achieving the required quality standard and client satisfaction. To achieve such project success, the project manager must possess the core project management competence and skills, and a qualified team project in order to effectively and efficiently manage all the resources required of them. The identification of factors that

influence the project performance and cause the poor performance of construction project enables appropriate allocation of limited resources.

1.7 Scope of the study

The focus of this research is to investigate the factors that lead to project performance and factors that cause the project delay. The specific area of study is the capital of Sudan, Khartoum. Both private and public companies of all sizes are considered in order to capture all the information that reflects the sizes of companies in Khartoum.

1.8 Research methodology

The method to be used in this research will include literature review of previous studies related to this study. A questionnaire will be developed for the propose of collecting data. The data obtained from the survey will be analyzed with the use of Statistical Package for the Social Sciences (SPSS). Specifically using, Relative Importance Index (RII), Spearman Correlation and Kruskal-Wallis.

1. 9 Organization of the research

This study is prepared to accomplish certain understanding about the factors that influence project performance in the Sudan construction industry, factors that could cause construction delays, and suggest the skills that the project manager should have in order to carry out successful project management. All the chapters have their own values and importance according to the topic. The

data collection will be obtained through administration of structured questionnaires. The dissertation is divided into six chapters:

1. Chapter 1- Introduction of research: this chapter is the most critical as it provides the initiated strategy and format of the research. It consists of the introduction which gives an overview of the need and the background of the research, problem statement, significance of research, scope of study, research questions, research objectives, research methodology.
2. Chapter 2- Literature review: this chapter provides comprehensive details on project performance and construction delay in the context of construction industry.
3. Chapter 3- The methodology: the methods of collection of data and questionnaire development which forms the research methodology.
4. Chapter 4- Data analysis and result: at this stage, all information and data obtained are analyzed and updated.
5. Chapter 5- Discussion of the findings: this chapter discusses the results obtained in chapter four of this research and it also explains the findings from discussion of the results.
6. Chapter 6- Recommendations and conclusion: the findings from the analysis will be concluded and suggestions will be recommended prior to the attainment of research objectives.

CHAPTER TWO

LITERATURE REVIEW

2.1 Definition of project

A project can be characterized by a few elements such as objectivity as it is definable with result, output or product, complexity with normally interrelated activities and large number of different tasks, unique where it is usually a "one-off" assignment, uncertainty as it has an element of risk, temporary with its well defined beginning and end and lastly operating in a life cycle as emphasis and resource needs change during the life of the project.

According to PMBOK (1996) a project is an organization's performed work. Work generally involves either operations or projects although the two mainly overlap. Operations or projects share many characteristics: performed by people, constrained by limited resources, planned, executed and controlled. In the construction industry, there is significant momentum for change in the way building processes are completed.

In contrast, according to Baguley (1999) project is a process or mechanism that enables an organization or individuals to focus resources and abilities towards desired outcomes and thus enabling an organization or individual to respond quickly to the desire of customers.

Gray and Larson (2003) defined a project as a complex, non routine, one time effort limited by time, budget, resource and performance specification designed

to meet customer's needs. It can also can be defined as a temporary endeavour, having a definitive beginning and definitive end, undertaken to create a unique product or service (PMI, 2000).

In Malaysia, project on the other hand, has been defined by Andrew (1996) as a series of task or activities that have specific objectives to be completed within certain specifications. It has specific start and end date, funding limits and which require inputs from various sources. A project can also be defined as the process of ensuring that set and stipulated project objectives such as performance, timely completion, and containment of costs within budget are clearly set out from the beginning, monitored and manage throughout the project duration.

The traditional, systematic process of planning, design, construction and occupancy, all performed by separate entities, is giving way to alternative approaches to project delivery. These approaches, consolidating groups of people traditionally responsible for separate functions in the project delivery, are resulting in new forms of organizational structure and hierarchy for the design and construction of these works.

In order for such projects to be successful, it is essential that participating organizations are comprised of staff that can work effectively with one another (Kichuk and Weisner, 1997). One of the first steps in any building construction project is the selection of professional service team. The optimal selection of firm's professional composition should take place before the project is begun,

and this will enhance the probability of the team's success (Kichuk and Weisner, 1997).

A construction project is commonly acknowledged as successful when it is completed on time, within budget, and in accordance with specifications and to stakeholders satisfaction. Functionally, profitability to contractor's absence of claims and court proceedings and "fitness for purpose" for occupiers has also been used as measures of project success (Takim and Akintoye, 2002).

Sanvido et al (1992) remarked that success on a project means that certain expectations for a given participant are met, whether owner, planner, engineer, contractor or operator. (Ashley et al., 1987 cited in Savido et al., 1992) referred to project success as having results much better than expected or normally observed in terms of cost, schedule, quality, safety and participant satisfaction.

De Wit (1988) remarked that a project is considered an overall success if it meets the technical performance specification and / or mission to be performed, and if there is a high level of satisfaction concerning the project's outcome among key people in the parent organization, key people in the project team and key users or clients of the project effort.

2.2 Definition of project management

Project management is essentially about managing a project from its conception to its completion and needs to be discussed in terms of various stages of a project life cycle. Project management is a discipline associated

with managing projects. Project management was defined as the art and science of managing a project from inception to closure as evidenced by successful product delivery and transfer where it involved the planning, scheduling, and controlling of project activities to achieve performance, cost, and time objectives as described by Project Management Institute (2000).

Project management is also defined as the process of controlling the achievement of the project objectives, using the existing organizational structures and resources and manage the project by applying a collection of tools and techniques without interrupting the routine operation of a company (Munns and Bjeirmi, 1996). Clarke (1999) stressed that project management is only a tool to help the process of change and when used timely can lead to problem solving of critical issues for an organization. The Project Management Institute (2004) defines project management as a set of processes that are applied to a project to deliver a product or service.

Mango (2008) said project management is simply: leading projects to successful conclusion by:

(i) Leading: Is a key element, because project management requires a leader who can influence others to act in ways that will improve chances of the project success. This might sound as simple undertaking. Influencing others is difficult because people are different. Each individuals and even business entities have their own interests, values, concerns, and background that are unique and attract special attention and focus on the part of the leader.

(ii) Planning: Is the backbone of project management. This is why it is considered an important element in project management. Companies report project success is directly proportionate to the amount of time spent on planning, while most will agree that planning is a key to project success. However, few managers are willing to commit or support a sufficient planning period on projects; most managers are in a hurry to do without taking enough time to prepare by planning.

(iii) Organizing: Is also big part of project management. Organizing includes organizing work, people, and resources in a way that they are utilized in the most optimal way possible to achieve project success. Organizing includes organizing work into a project, by defining clearly the scope of the project. Another important part of organizing is dividing clearly the project work into phases, with clear deliverables from each phase. A better solution is to organize the work of the project into phases that become roadmap towards project completion. Each phase answers some essential questions related to the project, reducing the risk and helping the team gain more knowledge and insight towards completing the final deliverable.

(iv) Controlling: This is another important part of project management. Nothing goes exactly as planned. This is why controlling is important. It gives an insight into how well the project is progressing, compared to the plan. Controlling includes the project stakeholders,

resources and the project environment. Resources include people, organization, materials, equipment, facilities, and information used to accomplish project work. Of all of them, the hardest to manage might be the people aspect. It is a known fact that most project problems are caused by people, not technology. This is why the people aspect of project management is key to the success of project manager.

The functions of the project management are defining the work requirement, allocation of resources needs, planning the execution of work required, monitoring the progress of the work and taking action in unexpected events that took place (Munns and Bjeirmi, 1996).

Project management in construction encompasses a set of objective which may be accomplished by implementing a series of operations subject to the constraints of resources. There are potential conflicts between the stated objectives with regards to scope, cost, quality and the constraints imposed on human, material and financial resources. These conflicts should be resolved at the onset of a project by making the necessary tradeoffs or creating new alternatives (Hendrickson and Au, 1998). An understanding of the underlying principles of project management can facilitate the identification of project management culture elements. Areas that need further clarification to indicate the systemic and holistic nature of project management are:

2.2.1 The Interdependencies in project management

One of the characteristics that distinguish project management from general management is the sheer breadth and complexity of the relationships that need to be managed. Project success depends on the co-operation of a wide range of individuals, many of whom do not directly report to the respective project manager. To be effective, a project manager must understand how these individuals or groups, often referred to as project stakeholders, can affect the project. Methods for managing this interdependency are thus crucial for success.

Project stakeholders are individuals and organizations that are actively in the project, or whose interests may be positively or negatively affected because of project implementation or successful project completion. The main stakeholders and their interdependence in the project environment are:

2.2.1.1 Customers define the scope of the project

Project success depends on their being satisfied. Project managers need to be responsive to changing customers' needs and requirements and need to meet customers' expectations. Customers are primarily concerned with getting a good deal and this naturally results in tension between customers and the project team.

2.2.1.2 Administrative support groups

Administrative support groups are responsible for managing and completing project work. Most participants want to do a good job, but they often have

other obligations, and they are concerned about how their involvement in the project could contribute to their reaching their personal goals and aspirations. Such support group as the human resources, information systems, procurement, finances, and maintenance function in an organization provide valuable support services. At the same time they impose constrains on and set requirements for the project, such as the documentation of expenditures and the timely and accurate delivery of information.

2.2.1.3 Functional managers

Functional managers naturally compete with each others resources and the support of top management. At the same time, they often have to share resources and exchange information. Depending on how the project is organized, they can play a minor or a major role in project success. In matrix structures, they may be responsible for assigning project personnel, resolving technical dilemmas, and overusing the completion of significant segments of the project work. Even in dedicated project teams, technical input from functional managers may be useful, and manager's acceptance of completed project work may be critical to in-house projects. Functional managers usually want to co-operate up to a point. They are also concerned with preserving their status within the organization and minimizing the disruptions the project may cause to their own operations.

2.2.1.4 Top management

Top management is responsible for strategic actions to counter external environment threats and exploit opportunities by effectively using the firm's

unique resources and capabilities. Selection and implementation of strategic actions are important in both entrepreneurial ventures and large established corporations (Boeker, 1997). In addition, top managers are the key players in networks to support entrepreneurial actions (West and Meyer, 1998). Carpenter and Fedrickson (2001) in their study found that top management's characteristics are related to the degree to which their firms are global, and such relationships are contingent upon the level of environmental uncertainty confronting them. The top management orientation is largely influenced by the nationality of the top managers.

According to Rugman and Hodgetts (2000) there are three basic sources of personnel talent that overseas companies and can fill top positions: home country nationals who reside abroad but are citizens of the parent country of the multinational, host country nationals who are local people hired by the overseas companies, third country nationals who are citizens of neither home nor host countries.

2.2.1.5 Sub-contractors

Subcontractors may do all actual construction work. In that case, the project team merely co-ordinates their contributions. They are responsible for ancillary segments of the project scope. Poor work and schedule delays can affect the work of the core project team. While contractors' reputation depends on their doing good work, they must balance their contributions with their own profit margins and their commitment to other business opportunities. Many researchers identified subcontractors as the key contributors to success in

construction project. Recognizing the importance of subcontracting in achieving project success, researchers began to address the subcontracting issues according to various perspectives, such as site productivity (Hsieh, 1998), quality of subcontractor's supply chain (Karim et al., 2006) and relationship with main contractors (Hinze and Tracey,1994; Kale and Arditi, 2001).

2.2.2 Project management approach

Grundy and Brown (2002) described conventional project management and contrasted it with strategic project management. Since project management involves a variety of tasks throughout a project lifecycle, the 'system approach' to project management has evolved. It is aimed at assisting managers in viewing the intricate details of a project and capturing it as an overview of a holistic phenomenon (Cleland and King, 1983). The strategic approach to project management is more concerned with the holistic nature and the strategic intent of the business.

2.3 Planning in project management

A project consists of three components: Scope, Budget and Schedule (Harold, 1998). It is important that all three of these components to be defined clearly and linked together since one affects the other, both individually and collectively. Scheduling is important because it brings together project definitions, people, cost, resources, timing, and method of performing work to define the logical sequence of activities for the project. The schedule is the final product of scope definition, budgeting, and planning and forms the basis

upon which all activities are measured. Project tracking and control cannot be accomplished without a good plan and schedule.

All project plans should specify key points within the project, deliverable at these points and threats represented by delay and failure of deliverables. The project plan should be a document which describes how the project work will be conducted, what is to be accomplished, when specific segments are performed, who is responsible and how much it will cost. The plan should define responsibilities and accountability for all the groups of people involved in the project. Construction contractor have the lead role during the construction phases, however, the client and designer have an important role as well. A cooperation environment of teamwork must be developed so that all parties can work together as a unit to achieve the project.

2.3.1 Principles of planning and scheduling

There must be an explicit operational plan to guide the entire project. The plan must include the three components of the project: scope, budget and schedule. Too often, planning is focused only on schedule without any regards to other important components of scope and budget.

Leicht (1999) stated that to develop an integrated total plan, the project must be broken down into well-defined units of work that can be measured and managed. This process starts with the work break down structure. Once this is complete, the project team members who have the expertise to perform the work will be required to produce the work. With this information, the complete

project plan can be developed. The project plan and schedule must clearly define individual responsibilities, schedules, budgets, and anticipated problems.

The project manager should prepare formal agreement with appropriate parties whenever there is a change in the project. There should be equally concern given to schedule and budget, and the two must be linked. Planning, scheduling, and controlling being at the inception of the project are continued throughout the life of the project until completion.

2.3.2 Construction planning

Construction planning as a fundamental and challenging activity in the management and execution of construction projects. It involves the choice of technology, the definition of work tasks, the estimation of the required resources and duration for individual tasks, and the identification of any interaction among the different work tasks.

A good construction plan is the basis for developing the budget and schedule for work. Developing the construction plan is a critical task in the management of construction, even if the plan is not written or otherwise formally recorded. In addition to these technical aspects of construction planning, it may also be necessary to make organizational decisions about the relationships between project participants and even which organizations to include in a project. Essential aspects of construction planning include the generation of required activities, analysis of the implications of these activities, and choice among the various alternative means of performing activities.

Construction planning is not an activity that is restricted to the period after the award of a contract for construction. It should be an essential activity during the facility design. In addition, if problems arise during construction, re-planning is required. As in the development of appropriate alternatives for facility design, choices of appropriate technology and methods for construction are often ill-structured yet these are critical ingredients in the success of the project. For example, a decision whether to pump or to transport concrete in buckets will directly affect the cost and duration of tasks involved in building construction. A decision between these two alternatives should consider the relative costs, reliabilities, and availability of equipment for the two-transport methods. Unfortunately, the exact implications of different methods depend upon numerous considerations for which information may be sketchy during the planning phase, such as the experience of expertise of workers or the particular underground condition at a site.

Construction project planning has a significant impact on the ability of construction firms to achieve success in the implementation of construction projects (Hamilton and Gibson, 1996). Nevertheless, although researchers in construction management and practitioners in the construction industry realize the importance of construction planning, there is a divergence of opinion on how much effort should actually be invested in construction planning activities and how construction-planning efforts should be organized to achieve success in the performance of construction projects.

Findings from some research studies have indicated that construction planning effectiveness and construction project performance can be improved by increasing the amount of resources invested in construction planning activities (Laufer and Cohenca, 1990; Faniran et al., 1999). A research by Arditi, (1985); Clayton, (1989); Syal et al (1992) they found that planning effort is one of factors effective of construction project performance.

Wixom and Barbara (2001) stated that there are several factors that are important in order to achieve a successful project during construction. A detailed construction schedule that is developed and used by the contractor who is performing the work; not the owner or designer, the owner should only define the start and end dates of the project. Contractors know their capabilities, resources, and how they plan to coordinate the many activities required to build the project in field. Thus, they are best qualified to develop a schedule to guide the numerous construction projects. According to Macomber and Hal (2003) planning skills are helpful for any undertaking; they are essential for the successful management of large complex projects. The project plan is the road map that defines how to achieve success from the start to the results.

2.3.3 Construction scheduling

A key output of project planning is the project master schedule. Along with supporting schedules, this is a graphic time representation of all necessary project related activities. The project schedule establishes the time parameters of the project and helps the managers to effectively coordinate and facilitate the